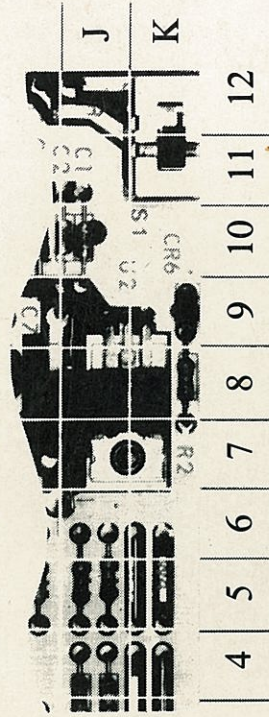


Remove staples and use cover for file folder.

- Quick Component Location using the SAMS exclusive GRIDTRACE, CIRCUITRACE, and component photographs.



- **Complete Components Parts List** in an easy to use format with field replacements shown when possible. SAMS unique semiconductor, chip and IC cross-reference gives you many replacements to choose from and is available at your Electronic Distributor.

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	REPLACEMENT DATA					
		MFGR. Part No.	ECG Part No.	NTE Part No.	RCA Part No.	/ENITH Part No.	NOTES
D102	IS553	1149-2576	ECG519	NTE519	SK9091/177	103-131	
D103	2N60FM	1149-2527	ECG109	NTE109	SK3088	103-29001	
D201	1N4004GP	1201-4205	ECG116	NTE116	SK3312	212-76-02	
D501 thru D503	IS553	1149-2576	ECG519	NTE519	SK9091/177	103-131	

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To order, or for more information see your Sams Distributor, or telephone 800-428-SAMS.



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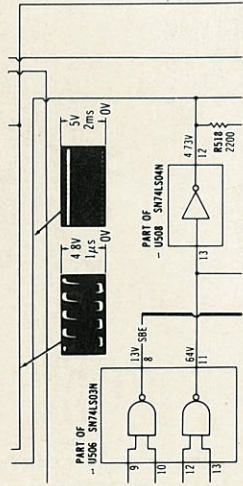
ISBN: 0-672-09031-6

ISBN: 0-672-09031-6

CSCS25
09037

The following information is just a sample of the many valuable time saving features contained in this exclusive Sams COMPUTERFACTS publication:

- Preliminary Service Checks section is an easy to use, step by step guide for the experienced technician or hobbyist, and even beginners.
- SAMS famous industry accepted standardized notation schematics containing CIRCUITRACE[®], GRIDTRACE[™], waveforms, voltages and stage identification.

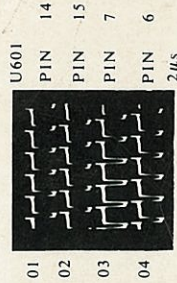


- Step by Step Troubleshooting guides the technician through the necessary procedures to quickly locate the problem.

TROUBLESHOOTING

MICROPROCESSOR CHIP (CPU) OPERATION

Verify the processor is functioning by checking the signals on the address lines (pins 10 thru 24 of IC U6000) and the data lines (pins 41 thru 56) using a logic probe or a scope if a logic probe is used, refer to the "Logic Chart" for the correct readings. If a scope is used, the waveforms on the address lines (except pins 22 and 23 which have no signal in Power Up mode) should be similar to Figure 1. The waveforms on the data lines should be similar to Figure 2.



- Logic Chart containing logic probe readings to isolate defective circuitry and components.

LOGIC

PIN NO	IC U000	PIN NO	IC U000	PIN NO	IC U000	PIN NO	IC U000	PIN NO	IC U000
1	P	21	P	1	I	1	L	1	L
2	P	22	P	2	P	2	P	2	P
3	P	23	P	3	H	3	H	3	H



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CSCS25 09037

COMPUTERFACTS™

Technical Service Data

COMMODORE® MODEL C128D COMPUTER

PRELIMINARY SERVICE CHECKS (Continued)

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove two screws from the bottom front and three screws from the rear. Slide the cabinet top back about 1/2 inch and lift it up to remove.

DISK DRIVE REMOVAL

Disconnect connectors CN12, CN14, CN15 and CN17. Pull off the knob from the front of the Drive. Remove one screw from the left side and two screws from the right side of the Drive. Slide the Drive back and remove.

POWER SUPPLY REMOVAL

Remove one screw holding the Power LED to the front panel. Disconnect Connector CN7. Remove two screws from the left side, two screws from the rear right and one screw from

the front right of the Power Supply. Lift the Power Supply out of the chassis.

MAIN SYSTEM BOARD REMOVAL

Remove one screw holding the Drive LED to the front panel. Remove one screw from the right side and one screw from the rear of the cabinet bottom that hold the Main System board. Remove eight screws from Connectors CN2, CN3 and CN4. Remove the hex spacer/screw that the Power Supply rested on. Remove seven screws holding the System board and lift the board out of the cabinet.

KEYBOARD DISASSEMBLY

Remove the six rubber feet and six screws from the Keyboard bottom and remove the bottom. Remove six screws holding the Keyboard to the top and remove the Keyboard.

MISCELLANEOUS ADJUSTMENTS

CHANGING DISK DRIVE DEVICE NUMBER

The Internal Disk Drive can be set to any device number from 8 to 11 by shorting or cutting two jumper pads located on the left side of IC U106 (as viewed from the front of Computer). Use the following chart to determine which pad to short or cut:
NOTE: Jumper 1 is the pad closest to the front of Computer.

Device Number	Jumper 1	Jumper 2
8	short	short
9	cut	short
10	short	cut
11	cut	cut

POWER SUPPLY VOLTAGE ADJUSTMENT

Connect the positive lead of a voltmeter to pin 4 of Connector CN7 and negative lead to ground. Turn Computer On and adjust 5V Adjust Control (VR2) for a reading of 5.0 volts.

14MHz OSCILLATOR

Connect Input of a frequency counter to pin 8 of IC U28. Adjust Trimmer Capacitor CT1 for a frequency of 14.31818MHz.

RF MODULATOR SOUND COIL

Connect Computer to a TV Monitor. Set TV and Computer Channel Select Switch to Channel 3. Type in and run the following Basic program:

10 VOL 5
20 SOUND 1,500,100
30 GOTO 10

Adjust the sound coil for best sound with Minimum noise.

SPINDLE SPEED CHECK

Center and paste strobe pattern (see Figure 1) on Drive Motor on bottom of Disk Drive. Insert a diskette into Drive and close Drive Door. Load a program from diskette or connect a Jumper from pin 3 of Connector CN17 to ground to turn the Motor On. Use outer section of pattern if 60HZ AC power is being used and inner section of pattern if 50Hz AC power is being used. Use a fluorescent light to view pattern. Speed is correct if pattern appears to stand still.

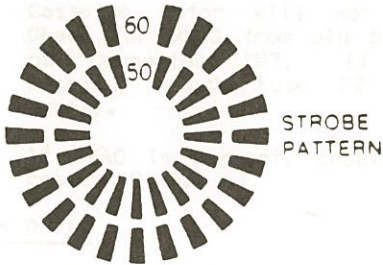


FIGURE 1

PRELIMINARY SERVICE CHECKS (Continued)
PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptible power supply may be needed to cure the problem. Do not switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If Disk Drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not clean the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

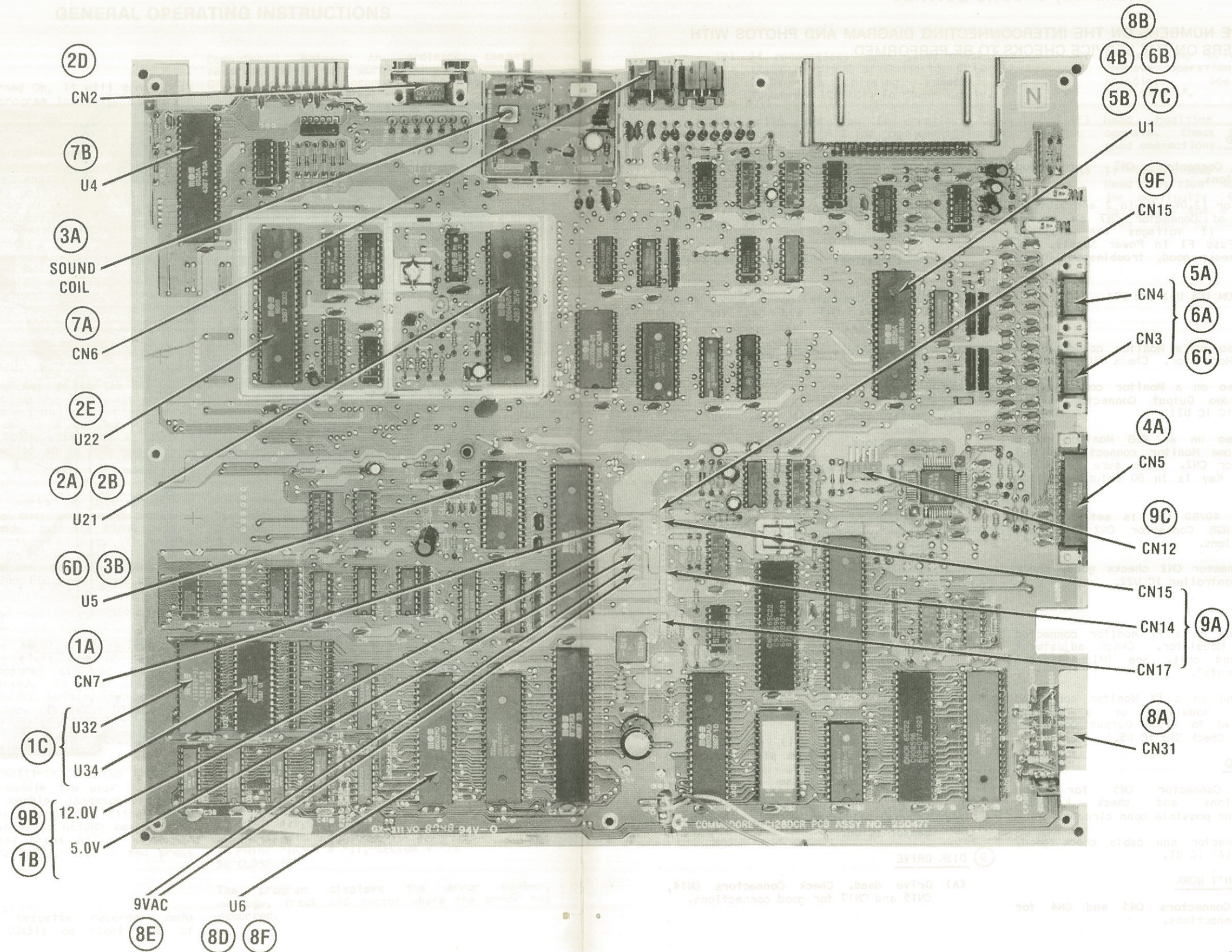
Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

COMMODORE
MODEL C128D

PRELIMINARY SERVICE CHECKS (Continued)



SYSTEM BOARD

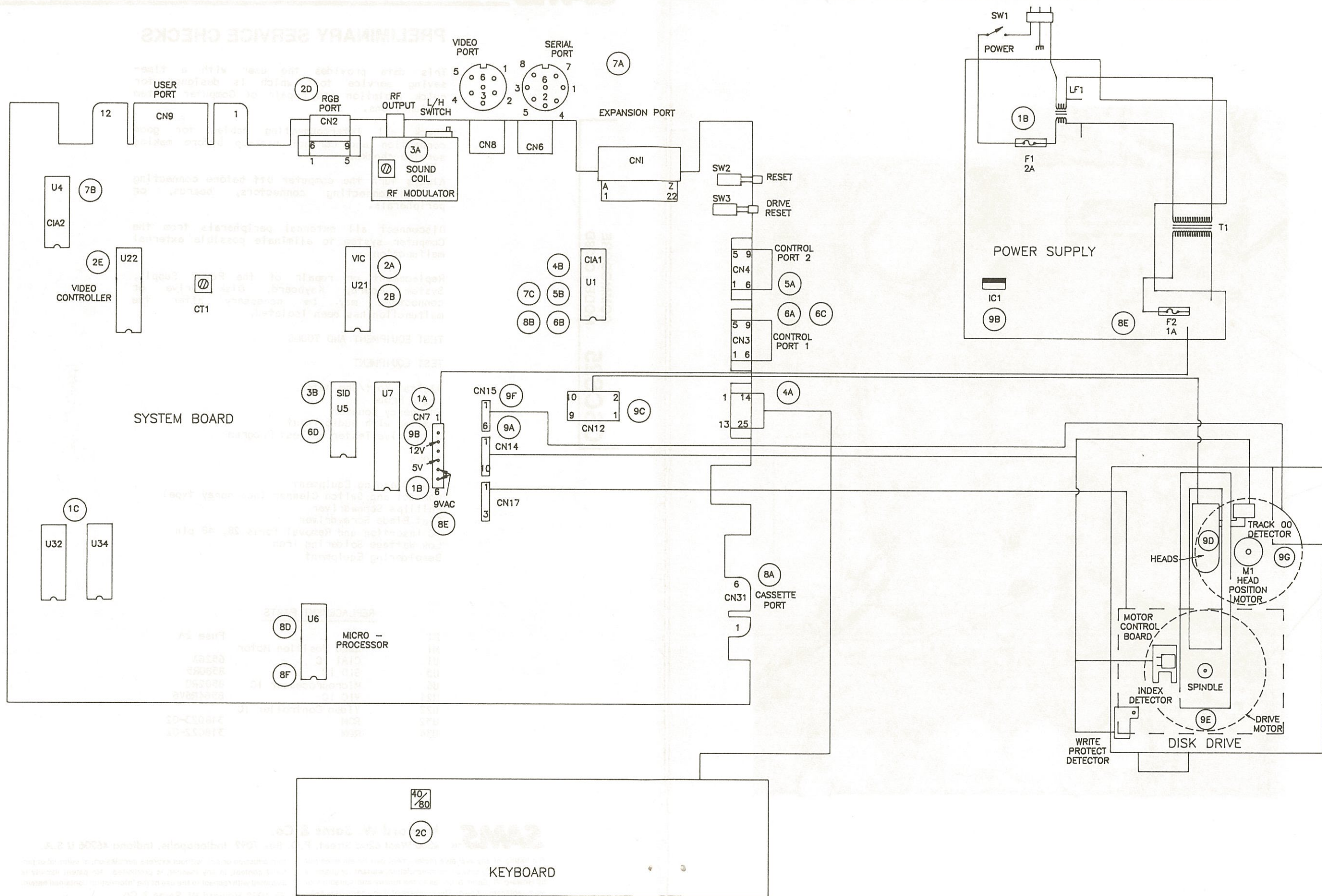
X

SYSTEM BOARD

III

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COMMODORE
MODEL C128D

PRELIMINARY SERVICE CHECKS (Continued)



COMMODORE
MODEL C128D

INTERCONNECTING DIAGRAM

INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Computer System malfunctions.

Check all interconnecting cables for good connection and correct hook-up before making service checks.

Always turn the computer Off before connecting or disconnecting connectors, boards, or peripherals.

Disconnect all external peripherals from the Computer system to eliminate possible external malfunctions.

Replacement or repair of the Power Supply, System Board, Keyboard, Disk Drive or connectors may be necessary after the malfunction has been isolated.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

- Digital Volt/Ohm Meter
- Logic Probe
- Frequency Counter
- Monitor with audio input
- Disk Drive Tester or Test Program

TOOLS

- Head Cleaning Equipment
- Contact and Switch Cleaner (non spray type)
- Phillips Screwdriver
- Flat Blade Screwdriver
- IC Insertion and Removal Tools 28, 48 pin
- Low Wattage Soldering Iron
- Desoldering Equipment

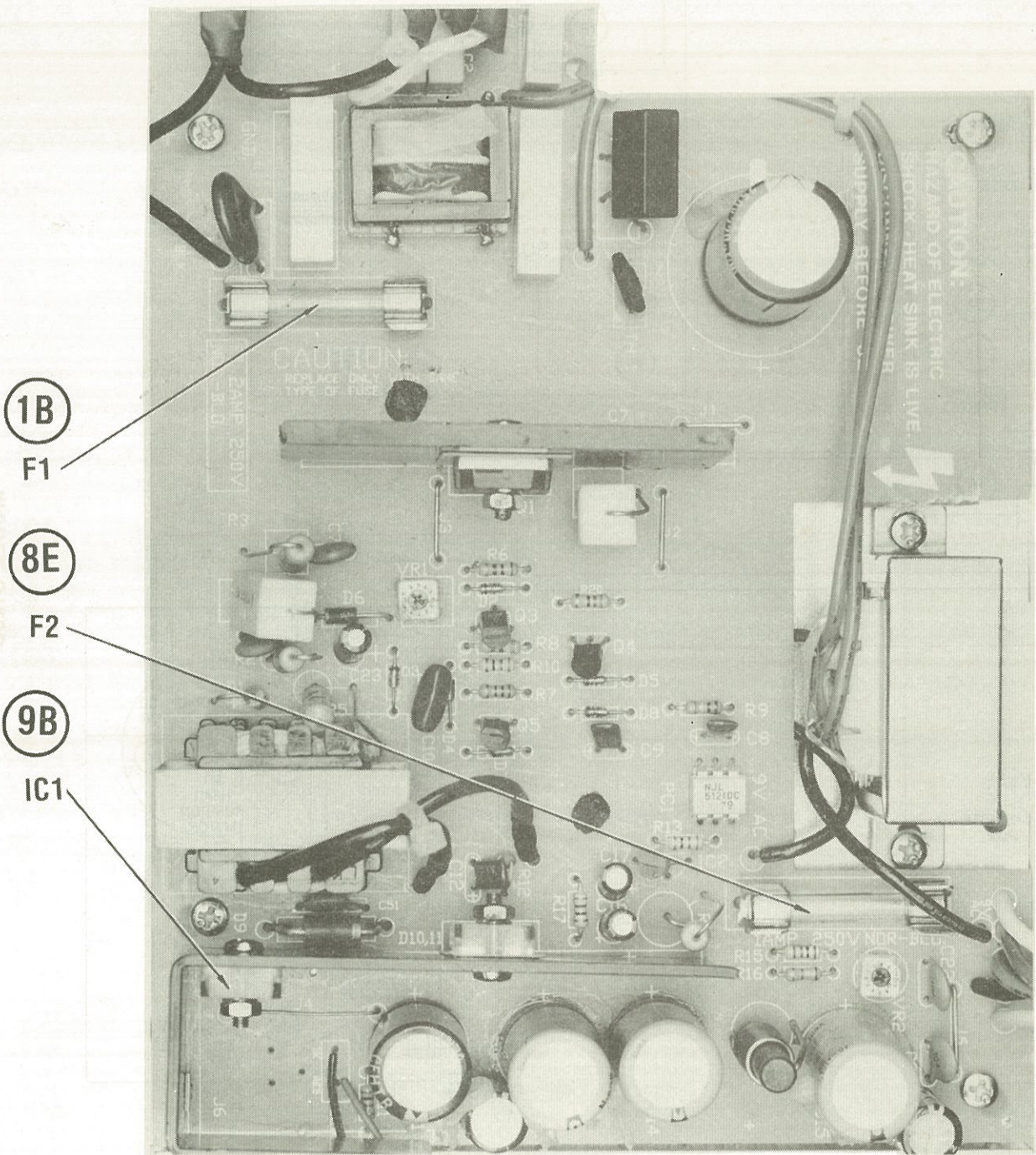
REPLACEMENT PARTS

F1	Fuse 2A
M1	Head Position Motor
U1	CIA1 IC
U5	SID IC
U6	Microprocessor IC
U21	VIC IC
U22	Video Controller IC
U32	ROM
U34	ROM
	6526A
	8580R5
	8502R0
	8564R6V6
	318023-02
	318022-02

SAMS Howard W. Sams & Co.
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The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co. as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co. by the manufacturers of the particular type of replacement part listed. **88CS19051** DATE 11-88

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COMMODORE
MODEL C128D
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CSCS25 COMMODORE
MODEL C128D

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.						NOTES
		NTE PART No.	ECG PART No.	TCE PART No.	ZENITH PART No.		
U32 U34 U36 U37 U38 THRU U41 U42	318023-02 318022-02 7406N M41464-12 SN74LS244N	NTE7406 NTE74LS244	ECG7406 ECG74LS244	SK7406 SK74LS244	HE-443-698 HE-443-791	USED SOME VERSIONS	
U50 U54 U55	74LS04 74LS32 MC74F245N	NTE74LS04 NTE74LS32	ECG74LS04 ECG74LS32	SK74LS04 SK74LS32	HE-443-755 HE-443-875		
U56 U57 U58	74LS74A 7407N 74LS03	NTE74LS74A NTE74LS03	ECG74LS74A ECG74LS03	SK74LS74A SK74LS03	HE-443-730 HE-443-745		
U60 U61 U63 U101 U102 U103	7407N 74LS08N 7406N 6502AD D27C256D-20 LC3517A-15	NTE74LS08 NTE7406 NTE6502	ECG74LS08 ECG7406 ECG6502	SK74LS08 SK7406	HE-443-780 HE-443-698		
U104 U105 U106 U107 U108 U109	65C22 251828-01 65C22 5710 MC2871A UPA2003C [uPA2003C]	NTE229 NTE2013	ECG229 ECG2013	SK3246A/229 SK9093/2013	121-Z9021 *		
U110 U111 U112 U113, 114	74LS123 74LS86 7406N 74LS14	NTE74LS123 NTE74LS86 NTE7406 NTE74LS14	ECG74LS123 ECG74LS86 ECG7406 ECG74LS14	SK74LS123 SK74LS86 SK7406 SK74LS14	HE-443-942 HE-443-891 HE-443-698 HE-443-872		

WIRING DATA

Shielded Hook-up Wire Use BELDEN No. 8401 or 8421 (Single-Conductor)
General-use Unshielded Hook-up Wire Use BELDEN No. 8208 (Two-Conductor)
Shielded Hook-up Wire (Disk Drive Heads)..Use BELDEN No. 8529 (Solid) Available in 13 Colors
8522 (Stranded) Available in 13 Colors
9534 (Four Conductor)

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C140 C141	1 50V NP 1 50V NP	

Items Not Listed Are Normally Available At Local Distributors.

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C1 C2 C3 C4 C24	POWER SUPPLY .1 125VAC 20% .0047 250VAC 20% .0047 250VAC 20% .0047 250VAC 20% .1 125VAC 20%	

ITEM No.	RATING	MFGR. PART No.
CT1	SYSTEM BOARD 4-40pF Trimmer	

Items Not Listed Are Normally Available At Local Distributors.

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
VR1 VR2	Regulator ADJ 5V ADJ	100 1000		

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
L1 LF1 T1 T2	POWER SUPPLY RF Choke Line Filter Power Transformer Power Transformer	
L1 L2	RF MODULATOR Peaking Coil Peaking Coil	

ITEM No.	FUNCTION	MFGR. PART No.
L3 L4 L5 L6 L7 L8 L9 L10	Peaking Coil Peaking Coil Peaking Coil Peaking Coil Peaking Coil RF Choke Oscillator Transformer Transformer	

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1 F2	2 Amp @ 250VAC Slow Blow 1 Amp @ 250VAC Fast Acting			

COMMODORE
MODEL C128D

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	
R1	POWER SUPPLY			
R3	15K 5% 5W WW			
R4	120 5% 3W Carbon Film	3W112		
R5	.33 5% 5W WW	5WD33		
R14	27 5% 3W Carbon Film	3W027		
TH1	27 5% 3W Carbon Film	3W027		
TH1A	12 Cold PTC			
	138 Cold PTC			
	SYSTEM BOARD			
RP1	Resistor Network (1)			
RP2	Resistor Network (1)			
RP3	Resistor Network (2)			
RP4	Resistor Network (3)			
RP5	Resistor Network (2)			
RP6	Resistor Network (3)			
RP7	Resistor Network (4)			
RP8	Resistor Network (2)			
RP101	Resistor Network (2)			

- (1) 1000 5% X 7.
(2) 3300 5% X 7.
(3) 33 5% X 4.
(4) 3300 5% X 5.

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
D12	POWER SUPPLY		
SW1	LED Switch		Power Indicator (Red) Power
SW1	RF MODULATOR Switch		Low/High
	SYSTEM BOARD		
CR98	LED		Drive Indicator (Green)
EM140	Filter		
EM141	Filter		
EM142	Filter		
FB7			
thru			
FB50	Ferrite Bead		
M1	Head Position Motor		
M2	Index Detector		
M3	Write Protect Detector		
M4	Track 00 Detector		
M5	Head		
SW2	Switch		Reset
SW3	Switch		Drive Reset
Y2	Crystal		14.31818MHz

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	TCE PART No.	ZENITH PART No.	NOTES
Q301	2SD313	NTE152	ECG152	SK3893/152	121-987-03	
U1	6526A	NTE4066B	ECG4066B	SK4066B	905-369	
U2	MC14066B	NTE74LS138	ECG74LS138	SK74LS138	HE-443-877	
U3	74LS138N					
U4	6526A					
U5	8580R5					
U6	8502R0					
U7	8722R2					
U8	74LS08N	NTE74LS08	ECG74LS08	SK74LS08	HE-443-780	
U9	MC74F32N					
U10	Z80	NTE3880	ECG3880	SK2880/3880	HE-443-881	
U11	8721R3					
U12	SN74LS373N	NTE74LS373	ECG74LS373	SK74LS373	HE-443-867	
U13	SN74LS244N	NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U14, 15	M74LS257AP	NTE74LS257	ECG74LS257	SK74LS257	HE-443-802	
U16	74LS14	NTE74LS14	ECG74LS14	SK74LS14	HE-443-872	
U17	SN74ALS373N					
U18	390059-01					
U19	LC3517A-15	NTE4066B	ECG4066B	SK4066B	905-369	
U20	MC14066B					
U21	8564R6V6					
U22	8568					
U23	M41464-12	NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U24	SN74LS244N					
U25	M41464-12					
U26	M74LS257AP	NTE74LS257	ECG74LS257	SK74LS257	HE-443-802	
U27	NE555GN	NTE978	ECG978	SK3689/978	221-Z9152	
U28	8701					
U30	7406N	NTE7406	ECG7406	SK7406	HE-443-698	
U31	74LS00	NTE74LS00	ECG74LS00	SK74LS00	HE-443-728	

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	TCE PART No.	ZENITH PART No.	NOTES
POWER SUPPLY						
BR1	RS204	NTE168	ECG168	SK3648/168	212-Z9001	
D1	FR155	NTE580	ECG580	SK5036/580	212-Z9000	
D2,3,4,5	1N4148	NTE519	ECG519	SK3100/519	103-131	
D6	FR105	NTE552	ECG552	SK9000/552	103-287	
D7,8	1N4148	NTE519	ECG519	SK3100/519	103-131	
D9	GI856	NTE580	ECG580	SK5036/580	212-Z9000	
D10	FEP168T	NTE6240	ECG6240	SK5060/6240	HE-442-674	
IC1	UA7812UC	NTE966	ECG966	SK3592/966		
IC2	UA431AUC					
PC1	NJL5121DC					
Q1	2SC3679	NTE2309	ECG2309			
Q3	2SD667C	NTE382	ECG382	SK9137/382	921-1114	
Q4	2SC1815GR	NTE85	ECG85	SK3124A/289A	121-Z9065	*
Q5	2SA1015GR	NTE290A	ECG290A	SK9132	121-Z9003	*
MAIN SYSTEM BOARD						
CR2 THRU CR7	9.0B2	NTE116	ECG116	SK3311	212-76-02	
CR8						
CR9,10,13,14						
CR16,17						
CR20,21,22,23						
CR101	1N4002					
CR102,3						
CR301						
DP1	DAN601					
DP2	DAP601					
DP3	DAN601					
DP4	DAP601					
Q1,2	2SC1815GR					
Q101	5610	NTE85	ECG85	SK3124A/289A	121-Z9065	*

LINE DEFINITIONS

A0 THRU A15 Address Bits 0 Thru 15
AD0-AD15..... Disk Drive Address Bits 0 Thru 15
AECAddress Enable Control
ATN Attention, Command Mode Selection
BA..... BUS Available
BUFEN.....Buffer Enable
BUSACK..... BUS Acknowledge
BUSREQDS0.....BUS Request
CASColumn Address Strobe
CE.....Chip Enable
CHAREN..... Character ROM Enable
CHAROM.....Charactor ROM Chip Select
CIA1,CIA2.....Complex Interface Adapter Select
Lines 1 and 2
CLK Clock
CLRBNKColor RAM Bank Select
CNT1,CNT2..... Count Input, Internal Timer Reference
COL0 THRU COL7... Keyboard Input Data, Columns 0 Thru 7
COLORAM Color RAM Chip Select
CS2.....Chip Select 2
CS8568Chip Select 8568
D0 THRU D7.....Data, Bits 0 Thru 7
D0 THRU DD7RGB RAM Data, Bits 0 Thru 7
DIRQ.....Disk Drive Interrupt Request
DMADirect Memory Access
DRES Dynamic RAM Reset
DR/W Disk Drive Read/Write
DWE.....Dynamic RAM Write Enable
EXROM External ROM Enable
EXTRES.....External Reset
FLAG1,FLAG2.....Data Transfer Controls 1 and 2
FROM1.....Function ROM 1 Select
FSDIR..... Fast Serial Direction, Disk Interface
GAEC.....Gated Address Enable Control
GAME..... Game ROM Enable
GCAS0,GCAS1Gated Column Address Strobe 0 and 1
GWE..... Gated Write Enable
HSYNC..... Horizontal Sync Pulse

I/O1,I/O2 Input/Output Selects 1 and 2
INTEN.....Intensity
IOACCInput/Output Access
IOCS..... Input/Output Chip Select
IRQ..... Interrupt Request
MA0 THRU MA7Multiplexed Address Bits 0 Thru 7
MTR/P5Motor Control/Port Bit 5
MUX Multiplexer
NMI.....Non-Maskable Interrupt
PA5..... Port A, Bit 5
PB0,PB4,PB7.....Port B, Bit 0, 4 and 7
POTXGame Paddle Control
POTYGame Paddle Control
R/W Read/Write
RASROW Address Strobe
RDATA..... Read Data
READY.....Ready, Current BUS Cycle Is To Be Completed
RESReset
RESET.....Reset, Initializes Internal Registers
ROM1,ROM3ROM Selects 1 and 3
ROMHExternal ROM Chip Select, High Status
ROML..... External ROM Chip Select, Low Status
ROW0 THRU ROW7.....Keyboard Input Data, Rows 0 Thru 7
SA0 THRU SA7.....Selected Address Bits 0 Thru 7
SID Sound Interface Device Chip Select
TA8 THRU TA15.....Translated Address Outputs
VA14,VA15..... Video Address Bits 14 and 15
VIC Video Interface Chip Select
VMA0 THRU VMA7.....VIC Multiplexed Address Bits 0 Thru 7
VSYNC..... Vertical Sync
WDATA Write Data
WE Write Enable
WGATE Write Gate
Z80 I/O.....Z80 Input Requesting Input/Output Access
128/64 C128 or C64 Operating Modes

SYSTEM NOTES

▽ Isolated ground
✱ Circuitry not used in some versions
--- Circuitry used in some versions
• See parts list
⊕ Ground
⏏ Chassis

Voltages, logic readings and waveforms taken with Computer in Power Up mode, no diskette in drive, no keys pressed and all locking keys in up position unless otherwise noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No Lights On)

- (1) Probe Indicates P when any key except RESTORE is pressed.
- (2) Probe Indicates P when key 1, 3, 5, 7, 9, +, £, HELP, ESC, ALT, or INST/DEL is pressed.
- (3) Probe Indicates P when key W, R, Y, I, P, *, —, RETURN or numeric keypad key 8, +, 0 is pressed.

- (4) Probe Indicates P when key A, D, G, J, L, ;, CONTROL, ^{CRSR} or numeric keypad key 5, -, . is pressed.
- (5) Probe Indicates P when key 2, 4, 6, 8, 0, -, F7, CLR/HOME, TAB, LINE FEED, or | is pressed.
- (6) Probe Indicates P when key Z, C, B, M, F1, ., R, SHIFT, SPACE, |, or numeric keypad key 2 or ENTER is pressed.
- (7) Probe Indicates P when key S, F, H, K, F3, :, =, ^{CRSR}, —, or numeric keypad key 4 or 6 is pressed.
- (8) Probe Indicates P when key Q, E, T, U, O, F5, @, |, — or numeric keypad key 7 or 9 is pressed.
- (9) Probe Indicates P when key X, V, N, ., /, L.SHIFT, RUN/STOP, NO SCROLL, ^{CRSR} or numeric keypad key 1 or 3 is pressed.
- (10) Probe Indicates L in C64 mode.
- (11) Probe Indicates L in 80 column mode.
- (12) Probe Indicates P in CP/M mode.

COMMODORE
MODEL C128D

LOGIC CHART

PIN NO	IC U1	PIN NO	IC U1	PIN NO	IC U2	IC U3	IC U4	PIN NO	IC U4	PIN NO	IC U5	PIN NO	IC U5
1	L	21	P	1	*	P	L	21	H	1	H	21	P
2	P	22	P	2	P	P	H	22	P	2	H	22	P
3	P	23	P	3	P	P	H	23	H	3	H	23	P
4	P	24	H	4	*	P	H	24	H	4	H	24	P
5	P	25	P	5	L	P	L	25	P	5	H	25	H
6	P	26	P	6	P	H	L	26	P	6	P	26	H
7	P	27	P	7	L	H	L	27	P	7	P	27	H
8	P	28	P	8	P	L	H	28	P	8	H	28	H
9	L(1)	29	P	9	P	H	H	29	P	9	P		
10	H(2)	30	P	10	P	H	H	30	P	10	P		
11	H(3)	31	P	11	P	P	H	31	P	11	P		
12	H(4)	32	P	12	P	P	H	32	P	12	P		
13	H(5)	33	P	13	L	P	H	33	P	13	P		
14	H(6)	34	H	14	H	P	H	34	H	14	L		
15	H(7)	35	P	15		H	H	35	P	15	P		
16	H(8)	36	P	16		H	H	36	P	16	P		
17	H(9)	37	P	17			H	37	P	17	P		
18	P	38	P	18			H	38	P	18	P		
19	P	39	H	19			P	39	H	19	P		
20	H	40	H	20			H	40	H	20	P		

PIN NO	IC U6	PIN NO	IC U6	PIN NO	IC U7	PIN NO	IC U7	PIN NO	IC U7	PIN NO	IC U8	IC U9
1	P	21	L	1	H	21	P	41	P	1	P	H
2	P	22	P	2	H	22	P	42	P	2	H	P
3	P	23	P	3	P	23	P	43	H	3	P	H
4	H	24	H	4	P	24	P	44	L	4	H	H
5	H	25	H	5	P	25	P	45	H	5	H	P
6	H	26	H	6	P	26	H	46	H	6	H	H
7	P	27	L	7	P	27	P	47	H(10)	7	L	L
8	P	28	L	8	P	28	P	48	H(11)	8	P	P
9	P	29	H	9	P	29	P			9	P	P
10	P	30	H	10	P	30	P			10	H	P
11	P	31	P	11	H	31	P			11	H	P
12	P	32	P	12	P	32	P			12	H	P
13	P	33	P	13	L	33	P			13	H(10)	P
14	P	34	P	14	P	34	L			14	H	H
15	P	35	P	15	P	35	P			15		
16	P	36	P	16	P	36	P			16		
17	P	37	P	17	P	37	P			17		
18	P	38	P	18	P	38	P			18		
19	P	39	P	19	P	39	P			19		
20	P	40	H	20	P	40	P			20		

DISK DRIVE TROUBLESHOOTING (Continued)

13 of IC U110. If pulses are missing, check IC U110, Capacitor C130 and Resistors R107 and R132. If pulses are present, check: IC U109; Capacitors C140 and C141; Switch Transistor Q101; Resistors R124 and R125; Head Position Motor (M1) windings for continuity.

DRIVE MOTOR

Drive motor will not run. Type in and run the following Basic program to turn the motor circuits On.

```
10 OPEN 15,8,15
20 PRINT#15,"M-W"CHR$(0)CHR$(28)CHR$(1)
  CHR$(244)
30 CLOSE 15
```

NOTE: Do not put any spaces in line 20. After running the program, check for logic high at pin 12 of VIA IC U104. If reading is not correct, check IC U104. If the reading is correct, check for logic low at pin 2 of IC U112. If reading is not correct, check IC U112. If reading is correct, check Connector CN17 for good connections and check the Motor Control Board.

TRACK 00 DETECTOR

Drive Heads bang against track 00 stop. Type in and run the following Basic program to check operation of Track 00 Detector (M4).

```
10 PRINT CHR$(147)
20 OPEN 15,8,15
30 PRINT#15,"M-R"CHR$(1)CHR$(24)CHR$(1)
40 GET#15,A$
50 X=ASC(A$) AND 1
60 IF X=0 THEN PRINT "ON ";:ELSE PRINT "OFF"
70 PRINT " TRACK 00"
80 PRINT CHR$(19):GOTO 30
```

NOTE: Do not put any spaces in lines 30 or 40. The program displays "On Track 00" on the screen if the Drive Head is manually pushed back to Track 00 and "Off Track 00" when the Drive Head is manually pushed off Track 00. If Track 00 Detector is not operating properly, check for logic low at pin 13 of IC U114 with the Head off Track 00 and logic high with the Head on Track 00. If readings are not correct, check pins 8 and 10 of Connector CN14 for good connections and check Track 00 Detector (M4). If readings are correct, check for logic high at pin 12 of IC U114 with the Head off Track 00 and logic low with the Head on Track 00. If readings are not correct, check IC U114. If the readings are correct, check VIA IC U106.

INDEX DETECTOR

To check Index Detector (M2), type in and run the program listed under "Drive Motor" to turn the Drive Motor On. Insert a diskette in the Drive and close the Drive door. While the Drive is running, check for pulses at pin 41 of IC U107. If pulses are missing, check: pins 4 and 5 of Connector CN14 for good connections; Index Detector (M2); Resistor R130.

DISK DRIVE TROUBLESHOOTING

MICROPROCESSOR (CPU) OPERATION

Check Reset circuit logic reading at pin 6 of IC U37 while turning the Computer On and again while pressing Drive Reset button (SW3). The reading should be low when Computer is turned On, then go high and stay high. The reading should go low when Drive Reset button is pressed. If reading is not correct when Computer is turned On, check reading at pin 9 of IC U63 while turning Computer On. The reading should be high when Computer is turned On, then go low and stay low. If reading is not correct, refer to "Microprocessor (CPU) Operation" troubleshooting section for the Computer. If reading is correct, check pin 5 of IC U16 for a logic low that goes high while turning Computer On, and check for logic low whenever the Drive Reset button is pressed. If reading is not correct, check IC U63, Capacitor C69, Diode CR14, Switch SW3 and Resistors R15 and R31. If reading is correct, check pin 6 of IC U16 for logic high while pressing Drive Reset button (SW3). If reading is not correct, check IC U16. If reading is correct, check IC U37.

Check for 1MHz clock waveform at pins 3, 37 and 39 of CPU IC U101. If waveform is missing at pin 37, refer to the "Oscillator and Dividers" section of this troubleshooting guide. If waveform is good at pin 37 and missing at pins 3 or 39 of IC U101, check IC U101.

OSCILLATOR AND DIVIDERS

Check for 16MHz waveform at pin 29 of IC U107. If waveform is missing or frequency is not correct, check Crystal Y1, IC U107 and Capacitors C116 and C117. If waveform is good, check for 16MHz waveform at pin 30 and 1MHz waveform at pins 3 and 4 of IC U107. If waveforms or frequencies are not correct, check IC U107.

READ CIRCUIT

Insert a formatted diskette with data on it into the Drive and close the Drive door. Connect a jumper from pin 3 of Connector CN17 to ground to keep Disk Drive running. Check for logic low at pins 11 and 12 and high at pin 13 of IC U111. If reading is not correct at pin 13, check IC U107. If reading is not correct at pin 12, check IC U105. If readings are correct at pins 12 and 13 and not correct at pin 11, check IC U111. If readings are correct, check waveforms at pins 3, 4 and 33 of Read/Write Amp IC U108. There should be a noticeable change in the pulses at pin 33 when the Drive door is opened and closed. If waveforms are not correct, check voltages and components associated with IC U108; Connector CN12 for good connections; Head (M5) windings for continuity.

WRITE CIRCUIT

Will not write. Verify the Write Protect circuits are working properly (see "Write Protect"). Check for pulses at pin 8 of IC U113 and pin 6 of IC U111 while injecting pulses at pin 9 of IC U113 with a logic pulser. If pulses are missing at pin 8 of IC

U113, check IC U113. If pulses are present at pin 8 of IC U113 and missing at pin 6 of IC U111, check IC U111. If pulses are present at both pins, check for pulses at pin 6 of IC U111 while injecting pulses at pin 5 of IC U111 and check for pulses at pin 11 of IC U111 while injecting pulses at pins 12 and 13 (one pin at a time). If pulses are missing, check IC U111. If pulses are present, check VIA IC U104 and Controller IC U105.

WRITE PROTECT

Type in and run the following Basic program to check operation of the Write Protect detector. The program displays "Write Protect On" on the screen if a write protected diskette is inserted in the Drive and "Write Protect Off" on the screen if a diskette that is not write protected is inserted in the Drive.

```
10 PRINT CHR$(147)
20 OPEN 15,8,15
30 PRINT#15,"M-R"CHR$(0)CHR$(28)CHR$(1)
40 GET#15,A$
50 X=ASC(A$) AND 16
60 PRINT "WRITE PROTECT ";
70 IF X=0 THEN PRINT "ON ";ELSE PRINT "OFF"
80 PRINT CHR$(19):GOTO 30
```

NOTE: Do not put any spaces in lines 30 or 40.

If the write protect circuit is not working, check for logic low at pin 11 of IC U114 with a not write protected diskette in the Drive and logic high with a write protected diskette in the Drive. If readings are not correct, check Pins 3 and 4 of Connector CN14 for good connections and check Write Protect Detector M3. If readings are correct, check for logic high at pin 10 of IC U114 with a not write protected diskette in the Drive and logic low with a write protected diskette in the Drive. If readings are not correct, check IC U114. If readings are correct, check VIA IC U104.

HEAD POSITION MOTOR

Head Position motor (M1) does not work. Check Connector CN15 for good connections. If connections check good, type in and run the following Basic program to activate Head Position Motor circuits.

```
10 OPEN 15,8,15
20 PRINT#15,"M-W"CHR$(0)CHR$(28)CHR$(1)CHR$(243)
30 PRINT#15,"M-W"CHR$(0)CHR$(28)CHR$(1)CHR$(241)
40 PRINT#15,"M-W"CHR$(0)CHR$(28)CHR$(1)CHR$(240)
50 GOTO 20
```

NOTE: Do not put any spaces in lines 20,30 or 40

While the above program is running, check for pulses at pins 10 and 11 of VIA IC U104. If pulses are missing, check IC U104. If pulses are present, check for pulses at pins 4, 10 and 12 of IC U113. If pulses are missing, check IC U113. If pulses are present, check for pulses at pins 3 and 8 of IC U111. If pulses are missing, check IC U111. If pulses are present, check for pulses at pins 12 and

LOGIC CHART (Continued)

PIN NO	IC U10	PIN NO	IC U10	PIN NO	IC U11	PIN NO	IC U11	PIN NO	IC U11	PIN NO	IC U12	IC U13	IC U14
1	P	21	*(12)	1	P	21	P	41	P	1	*(12)	H	P
2	P	22	H	2	P	22	H	42	P	2	*(12)	*(12)	P
3	P	23	L	3	P	23	H	43	P	3	P	P	P
4	P	24	H	4	P	24	L	44	P	4	P	*(12)	P
5	P	25	L	5	P	25	L	45	P	5	*(12)	P	P
6	P	28	H	6	P	26	H	46	P	6	*(12)	*(12)	P
7	*(12)	27	H	7	L	27	L	47	P	7	P	P	P
8	*(12)	28	H	8	H	28	*	48	H	8	P	*(12)	L
9	*(12)	29	L	9	P	29	P			9	*(12)	P	P
10	*(12)	30	P	10	P	30	H			10	L	L	P
11	H	31	P	11	H	31	H			11	P	*(12)	P
12	*(12)	32	P	12	H	32	H			12	*(12)	P	P
13	*(12)	33	P	13	H	33	H			13	P	*(12)	P
14	*(12)	34	P	14	H(12)	34	P			14	P	P	P
15	*(12)	35	P	15	H(10)	35	P			15	*(12)	*(12)	P
16	P	36	P	16	L	36	P			16	*(12)	P	H
17	H	37	P	17	P	37	P			17	P	*(12)	
18	H	38	P	18	P	38	P			18	P	P	
19	*	39	P	19	P	39	P			19	*(12)	H	
20	H(12)	40	P	20	P	40	P			20	H	H	

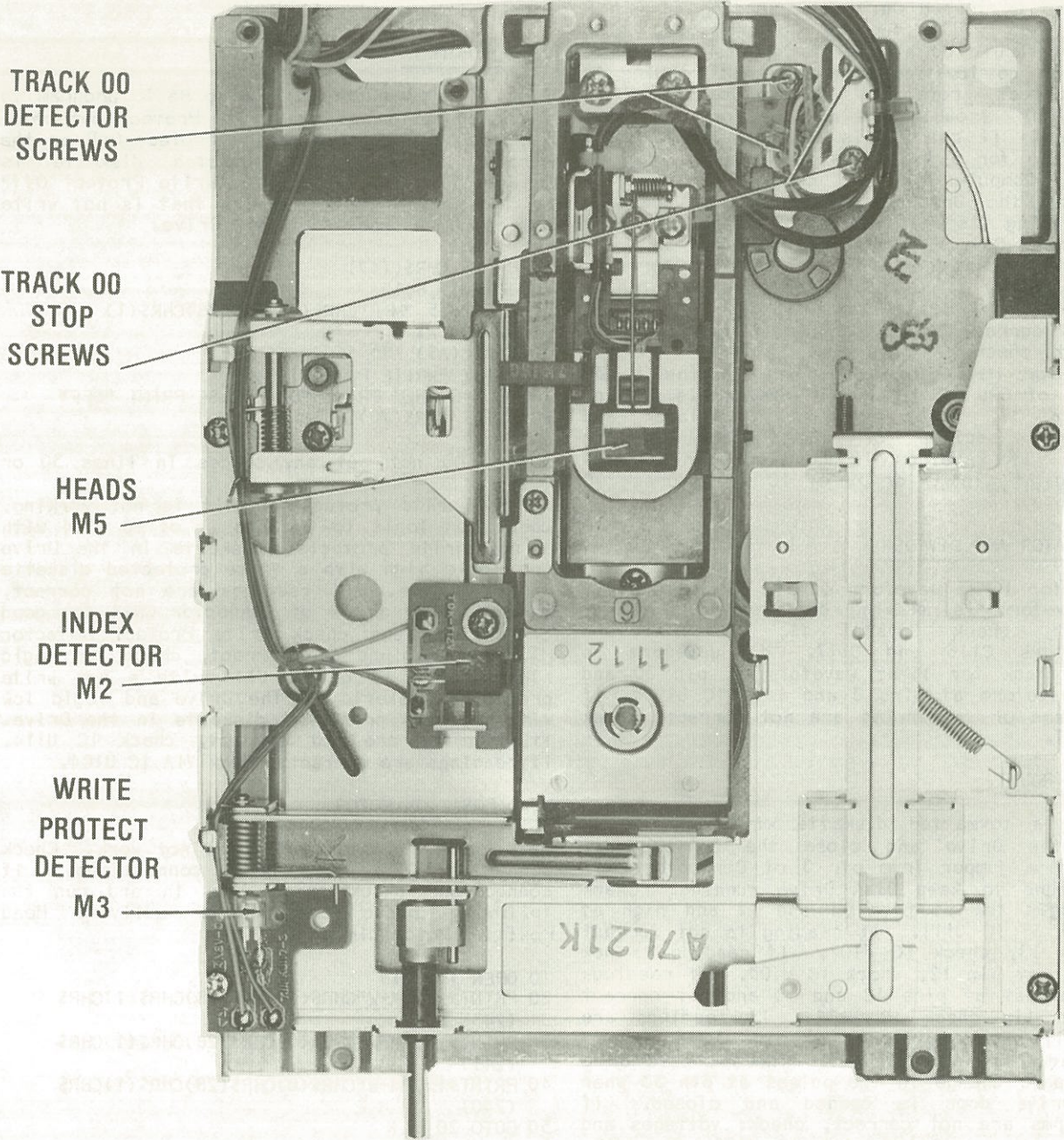
PIN NO	IC U15	IC U16	IC U18	IC U18	PIN NO	IC U18	PIN NO	IC U19	PIN NO	IC U19	PIN NO	IC U20
1	P	L	P	P	21	H	1	H	21	P	1	P
2	P	H	P	P	22	P	2	P	22	P	2	P
3	P	H	P	P	23	P	3	P	23	P	3	P
4	P	L	P	P	24	H	4	P	24	H	4	P
5	P	H	P	P			5	P			5	P
6	P	P	L	P			6	P			6	P
7	P	L	P	P			7	P			7	L
8	L	L	P	P			8	P			8	P
9	P	H	P	P			9	P			9	P
10	P	P	L	P			10	P			10	P
11	P	P	P	P			11	P			11	P
12	P	L	P	L			12	L			12	P
13	P	H	P	P			13	P			13	P
14	P	H	P	P			14	P			14	H
15			P	P			15	P			15	
16	H		P	P			16	P			16	
17			P	P			17	P			17	
18			P	P			18	P			18	
19			P	P			19	H			19	
20			H	P			20	P			20	

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LOGIC CHART (Continued)

PIN NO	IC U21	PIN NO	IC U21	PIN NO	IC U21	PIN NO	IC U22	PIN NO	IC U22	PIN NO	IC U22	PIN NO	IC U23
1	P	21	P	41	P	1	P	21	H	41	P	1	L
2	P	22	P	42	P	2	P	22	L	42	P	2	P
3	P	23	P	43	P	3	P	23	H	43	L	3	P
4	P	24	L	44	P	4	P	24	L	44	L	4	H
5	P	25	P	45	P	5	P	25	H	45	L	5	P
6	P	26	L	46	P	6	P	26	P	46	L	6	P
7	P	27	L	47	P	7	P	27	P	47	L	7	P
8	P	28	L	48	H	8	P	28	P	48	P	8	P
9	H	29	P			9	*	29	P			9	H
10	P	30	P			10	P	30	P			10	P
11	H	31	P			11	P	31	P			11	P
12	P	32	P			12	L	32	P			12	P
13	P	33	P			13	P	33	P			13	P
14	P	34	P			14	P	34	P			14	P
15	P	35	P			15	P	35	P			15	P
16	H	36	P			16	P	36	P			16	P
17	P	37	P			17	P	37	H			17	P
18	P	38	P			18	P	38	P			18	L
19	P	39	P			19	P	39	P			19	
20	P	40	P			20	P	40	P			20	

PIN NO	IC U24	IC U25	IC U26	IC U27	IC U28	IC U30	IC U31	IC U32	PIN NO	IC U32
1	L	L	P		*	H	H	H	21	P
2	L	P	L		L	L	L	P	22	P
3	L	P	P		*	L	H	P	23	P
4	L	H	P	*	L	H	H	P	24	P
5	L	P	L	L	H	H	H	P	25	P
6	L	P	P	L	H	L	L	P	26	P
7	L	P	P	L	H	L	L	P	27	H(1)
8	L	P	L	L	H	H	H	P	28	H
9	P	H	H	L	L	L	L	P		
10	L	P	*	L	*	L	L	P		
11	P	P	*		*	L	P	P		
12	L	P	P		H	L	H	P		
13	P	L	P		P	H	P	P		
14	L	P	P	H	H	H		P		
15	L	P	P		H			P		
16	L	P	P		H			P		
17	L	P	P	P	P	P		P		
18	L	L	L	L	L	P		P		
19	L							P		
20	H							L		



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DISK DRIVE - TOP VIEW

TROUBLESHOOTING (Continued)

from 0 to 255 as a paddle is operated and should be greater than 255 whenever a paddle button is pressed. If numbers are not correct, check Connectors CN3 and CN4 for good connections. If buttons do not work, check Capacitors and Diodes connected to pins 3 and 4 of Connectors CN3 and CN4. If Capacitors and Diodes check good, check CIA1 IC U1. If paddles do not work, check Capacitors and Diodes connected to pins 5 and 9 of Connectors CN3 and CN4. If Capacitors and Diodes check good, check for pulses at pins 5 and 6 of IC U2 while the above program is running. If pulses are missing, check CIA1 IC U1. If pulses are present, check for a variation in waveforms at pins 2 and 3 of IC U2 while operating paddles (with program running). If there is no variation, check IC U2. If waveforms are missing, check Capacitors C96 and C97 and SID IC U5.

CASSETTE PORT

Type in the following Basic program and run it while performing the tests in the following paragraphs:

```

10 POKE 0,47
20 PRINT PEEK(56333) AND 16,
30 PRINT PEEK(1) AND 16
40 POKE 1,123:POKE 1,83
50 GOTO 20

```

NOTE: Disconnect the Cassette Recorder from Connector CN31 when running this program. The program displays two columns of numbers on the Monitor screen. The number in the first column indicates the status of cassette read pin (pin 4) of Cassette Connector CN31 and should change between 0 and 16 when a jumper is connected from pin 4 to pin 5 of Connector

CN31. The number in the second column indicates the status of cassette sense pin (pin 6) of Connector CN31 and should change from 16 to 0 whenever pin 6 of Connector CN31 is shorted to ground. The program also generates pulses at pins 3 and 5 of Connector CN31. Check Connector CN31 for good connections. Verify Cassette Sense pin (pin 6) of Connector CN31 is working by observing the number in the second column on the Monitor while shorting pin 6 to ground. If the number on the Monitor screen does not change from 16 to 0, check Capacitor C304, Resistor R304 and Microprocessor IC U6. Computer will not save a program to tape. Check for pulses at pin 27 of IC U6. If pulses are missing, check Capacitor C303, Resistor R302 and IC U6.

Computer will not load a program from cassette tape. Connect a Jumper from pin 4 to pin 5 of Connector CN31. The number in the first column should be changing between 0 and 16. If the number does not change, check Capacitor C302, Resistor Pack RP7 from pin 7 to pin 1 and IC U1.

Cassette motor will not start or will not stop. Check for 9VAC from pin 5 to pin 6 of Connector CN7. If 9VAC is missing, check Capacitors C78 and C79 and check Fuse F2 and Transformer T1 in the Power Supply. If 9VAC is present, check for 13.1V at the Collector of Cassette Switch Transistor Q301. If voltage is missing, check Capacitor C88, Rectifier CR13 and Resistor R5. If the voltage is present, check for pulses at pin 25 of IC U6. If pulses are missing, check IC U6. If pulses are present, check IC U30, Zener Diode CR301, Cassette Switch Transistor Q301 and Resistor R301.

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove two screws from bottom front and three screws from the rear. Slide the cabinet top back about 1/2 inch and lift up to remove.

DISK DRIVE REMOVAL

Disconnect connectors CN12, CN14, CN15 and CN17. Pull the knob from the front of the Drive. Remove one screw from the left side and two screws from the right side of the Drive. Slide the Drive back and remove.

POWER SUPPLY REMOVAL

Remove one screw holding Power LED to front panel. Disconnect Connector CN7. Remove two screws from left side, two screws from rear right and one screw from front right of Power Supply. Lift Power Supply out of the chassis.

HEAD CLEANING INSTRUCTIONS

Use a lint free cloth or swab dampened with 91% Isopropyl alcohol to clean disk drive heads. Dry with a lint free cloth.

MAIN SYSTEM BOARD REMOVAL

Remove one screw holding Drive Led to front panel. Remove one screw from right side and one screw from rear of cabinet bottom to release Main System board. Remove eight screws from Connectors CN2, CN3 and CN4. Remove hex spacer/screw that Power Supply rested on. Remove seven screws holding System board and lift board out of the cabinet.

KEYBOARD DISASSEMBLY

Remove six rubber feet and six screws from Keyboard bottom and remove the bottom. Remove six screws holding Keyboard to the top and remove Keyboard.

LOGIC CHART (Continued)

PIN NO	IC U34	PIN NO	IC U34	PIN NO	IC U37	IC U38	IC U39	IC U40	IC U41	IC U42	IC U50	IC U54	IC U55
1	H	21	P	1	H	L	L	L	L	H	P	*	H
2	P	22	P	2	L	P	P	P	P	P	P	*	P
3	P	23	P	3	P	P	P	P	P	P	P	H	P
4	P	24	P	4	L	P	P	P	P	P	L	*	P
5	P	25	P	5	L	P	P	P	P	P	H	*	P
6	P	26	P	6	H	P	P	P	P	P	L	H	P
7	P	27	P	7	L	P	P	P	P	P	L	L	P
8	P	28	H	8	P	P	P	P	P	P	H	P	P
9	P			9	L	H	H	H	H	P	L	P	P
10	P			10	P	P	P	P	P	L	H	P	L
11	P			11	P	P	P	P	P	P	L	P	P
12	P			12	H	P	P	P	P	P	P	P	P
13	P			13	L	P	P	P	P	P	P	P	P
14	L			14	H	P	P	P	P	P	H	H	P
15	P			15		P	P	P	P	P			P
16	P			16		P	P	H	H	P			P
17	L			17		P	P	P	P	P			P
18	P			18		L	L	L	L	P			P
19	P			19						H			P
20	L			20						H			H

PIN NO	IC U56	IC U57	IC U58	IC U60	IC U61	PIN NO	IC U63
1	H	L	L	H	P	1	P
2	L	L	L	H	H	2	L
3	P	P	L	H	P	3	L
4	H	P	L	H	H	4	H
5	L	L	L	H	P	5	H
6	H	L	H	H	P	6	L
7	L	L	L	L	L	7	L
8	P	P	L	L	P	8	H
9	P	P	L	H	P	9	L
10	P	P	H	P	H	10	H
11	P	P	H	P	L	11	L
12	P	L	H	P	P	12	H
13	H	P	L	P	P	13	L
14	H	H	H	H	H	14	H
15						15	
16						16	

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ALIGNMENT

ALIGNMENT TEST SETUP

NOTE: Use a Dyan Analog Alignment Diskette 208-10 when an alignment diskette is specified in the alignment procedures. This alignment diskette has only alignment patterns on it and does not contain any alignment programs.

Use the following Track Seek program and procedure to step the head to a track when specified in the alignment procedure.

```
10 OPEN 15,8,15,"I"
20 OPEN 8,8,8,"#"
30 PRINT "TYPE 99 TO EXIT"
40 INPUT "TRACK";T
50 IF T=99 THEN 90
60 T=T+1
70 PRINT#15,"U1:"8;0;T;0
80 GOTO 30
90 CLOSE 15: CLOSE 8
```

NOTE: Do not put any spaces in line 70.

Turn Disk Drive On. Run above program and step head to specified track with NO diskette in Disk Drive. The Disk Drive will try to find the track, then it will go back to Track 00. It will then go to the track specified and stop. After Disk Drive stops, insert Alignment Diskette into Disk Drive and close door. Connect a jumper from pin 3 of Plug CN17 to ground to keep Disk Drive running and perform alignment procedure. Whenever head must be set to a different track, remove jumper from pin 3 of Plug CN17 to stop Disk Drive, and remove Alignment Diskette. NOTE: If program does not work after removing diskette, type 99 to stop program, then type RUN to start program again.

SPINDLE SPEED CHECK

Center and paste strobe pattern, (see Figure 1) on Drive Motor on bottom of Disk Drive. Insert a diskette into Drive and close Drive door. Load a program from diskette or connect a jumper from pin 3 of Connector CN17 to ground to turn the motor On. Use outer section of pattern if 60Hz AC power is being used and inner section of pattern if 50Hz AC power is being used. Use a fluorescent light to view pattern. Speed is correct if pattern appears to stand still.

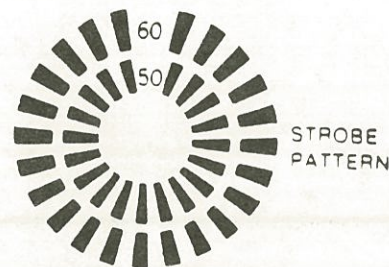


Figure 1

RADIAL HEAD ALIGNMENT

Connect channel A Input of a dual trace scope to TP1 (pin 3 of IC U108) and channel B Input to TP2 (pin 4 of IC U108). Set scope for external trigger mode and connect external trigger Input to pin 4 of Connector CN14. Set scope to positive trigger slope, add mode, with channel B inverted, sweep time to 20ms, voltage to .2V/cm range and scope Inputs to AC Input. Set head to Track 16, see "Alignment Test Setup". Insert an Alignment Diskette into Disk Drive and connect a jumper from pin 3 of Connector CN17 to ground to keep Drive running. Observe catseye pattern (see Figure 2). The peak to peak amplitude of lobes should be within 70% of each other. If lobes are out of tolerance, loosen two screws holding Head Position Motor (M1) mounting bracket and rotate motor until lobes are within 90% of each other. Tighten mounting bracket screws.

Remove jumper from pin 3 of Connector CN17. Remove Alignment Diskette from Disk Drive. Use the Track Seek program, see "Alignment Test Setup" section, to set head to Track 34 and back to Track 16. Insert Alignment Diskette into Disk Drive. Connect jumper from pin 3 of Connector CN17 to ground and verify lobes are within tolerance when head is on Track 16. Repeat procedure again stepping head to Track 00 and back to Track 16. Check Track 00 Stop and Detector adjustments.

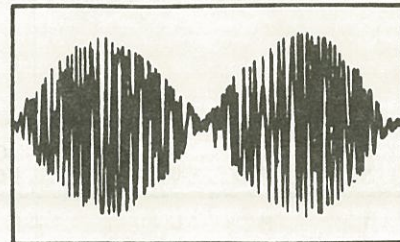


Figure 2

TRACK 00 STOP AND DETECTOR ADJUSTMENT

Check "Radial Head Alignment" before making Track 00 adjustments. Connect input of scope to TP1 (pin 3 of IC U108). Set sweep time to 10us voltage range to .2V. Set head to Track 00 (see "Alignment Test Setup"). Insert Alignment Diskette and close Drive door. Connect a jumper from pin 3 of Connector CN17 to ground to keep drive running. Verify head is on Track 00 by checking for a 125kHz waveform at TP1 (see Figure 3). If 125kHz signal is not present, step head forward or back until 125kHz signal is present.

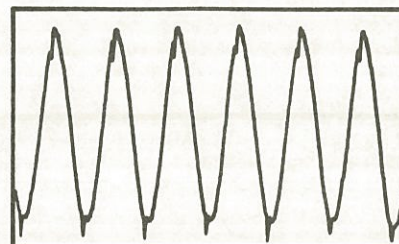


Figure 3

TROUBLESHOOTING (Continued)

```
60 GOTO 120
70 POKE X,0
80 IF PEEK(X) AND Z THEN 120
90 NEXT Y:RESTORE
100 NEXT X
110 PRINT "TEST COMPLETED":END
120 PRINT "BIT ";Y-1;" AT ADDRESS ";X;" CHECKS BAD"
130 GOTO 90
```

If color is not working at all, type in and run the following Basic program:

```
10 POKE 55300,8:GOTO 10
```

While the program is running, check for pulses at pins 18 and 21 of IC U19. If pulses are missing at pin 18, check PLA IC U11. If pulses are missing at pin 21, check IC U56. If pulses are present, check IC U19. Also see "Color" section.

SERIAL PORT (CN6)

Peripherals connected to Serial Connector (CN6) do not work. Check Connector CN6 for good connections. If connections check good, check for logic low at pin 4 of IC U60 while pressing Reset Button (SW2). If reading is not correct, check IC U60. If reading is correct, type in and run the following Basic program:

```
10 SCNCLR:POKE 56578,63
20 POKE 56576,63
30 PRINT PEEK(56576) AND 192
40 POKE 56576,3
50 PRINT PEEK(56576) AND 192
60 CHAR,0,0:GOTO 20
```

The program generates pulses at pins 5, 6 and 7 of CIA2 IC U4 and displays two numbers on the Monitor screen that indicate the status of pins 8 and 9 of IC U4.

The numbers should be 0 and 192. While the program is running, check for pulses at pin 23 of IC U4. If pulses are missing, check Decoder IC U3. If pulses are present, check for pulses at pins 5, 6 and 7 of IC U4. If pulses are missing, check IC U4. If pulses are present, check for pulses at pins 4, 8 and 10 of IC U30. If pulses are missing at pin 4, check Capacitor C66, Diodes CR4 and CR5, IC U30 and Resistor Pack RP1 from pin 4 to pin 1. If pulses are missing at pin 8, check Diodes CR2 and CR7, IC U30 and Resistor Pack RP1 from pin 6 to pin 1. If pulses are missing at pin 10, check Diodes CR3 and CR6, IC U30 and Resistor Pack RP1 from pin 5 to pin 1. If pulses are missing at all three pins, check IC U30. If pulses are present at all three pins and the numbers displayed on the Monitor are not correct, check IC U4.

If pulses are present at ICs U4 and U30 and the numbers on the monitor are correct, type in and run the following Basic program:

```
10 POKE 56324,0:POKE 56325,1
20 POKE 56334,87
30 POKE 56332,66:GOTO 30
```

While the program is running, check for pulses at pins 16, 39 and 40 of CIA1 IC U1. If

pulses are missing at any pin, check IC U1. If pulses are present at all pins, check for pulses at pins 4 and 6 of IC U50. If pulses are missing, check IC U50. If pulses are present, press RUN/STOP and RESTORE keys at the same time to stop the program. With no diskette in the Disk Drive, check for pulse at pin 44 of MMU IC U7 each time Function key F3 (Directory) is pressed. If no pulse appears, check IC U7. If pulse appears, check for pulse at pins 3 and 6 of IC U56 each time the F3 key is pressed. If no pulse appears, check IC U56. If pulse appears, check for pulse at pin 2 of IC U16 each time the F3 key is pressed. If pulse is missing, check IC U16. If pulse is present, check for a pulse at pin 11 of IC U8 each time the F3 key is pressed. If pulse is missing, check IC U8. If pulse is present, check IC U60 and Diodes CR9 and CR10.

JOYSTICKS

Joysticks do not work. Check Control Ports 1 and 2 Connectors, CN3 and CN4, for good connections. If connections check good, type in and run the following Basic program:

```
10 PRINT CHR$(147)
20 P1=PEEK(56321) AND 31
30 P2=PEEK(56320) AND 31
40 PRINT "PORT 1=";P1
50 PRINT "PORT 2=";P2
60 PRINT CHR$(19):GOTO 40
```

The program displays the number 31 for each port with the joystick in the center position. The following numbers should appear with the joystick in the indicated position:

POSITION	NUMBER	PORT 1 CN3 PIN	PORT 2 CN4 PIN
UP	30	1	1
DOWN	29	2	2
LEFT	27	3	3
RIGHT	23	4	4
BUTTON	15	6	6

NOTE: Other numbers will appear if two switches on the joystick are closed at the same time.

If none of the numbers are correct, check CIA1 IC U1. If the number is not correct in only one position, check the Capacitors and Diodes connected to the pin with the incorrect number. If the Capacitors and Diodes check good, check IC U1.

PADDLES

The following Basic program can be used to check operation of the paddles:

```
10 SCNCLR
20 FOR N= 1 TO 4
30 P(N)=POT(N):P$(N)=STR$(P(N)) + " "
40 PRINT "PADDLE ";N;"=";P$(N)
50 NEXT N:CHAR,0,0:GOTO 20
```

The program displays, on the Monitor screen, a number for each of four paddles (paddles 1 and 2 connected to Port 1, paddles 3 and 4 connected to Port 2). The number should vary

TROUBLESHOOTING (Continued)

Connector CN8. Check waveform at pin 17 of IC U21. If waveform is missing, check IC U21. If waveform is present, check the voltages and components associated with Transistors Q1 and Q2 on the RF Modulator board and check Filter EM140.

No video on Connector CN2 connected to an RGB Monitor. Make sure the 40/80 Display key is in 80 column mode (down). Check Video Controller IC U22 horizontal sync waveform at pin 4, vertical sync waveform at pin 20, and pulses at pins 44 and 45. If waveforms or pulses are missing, check IC U22 and RAM IC's U23 and U24. If waveforms and pulses are present, check Buffer IC U24.

No video on Connector CN2, connected to a Monochrome Monitor, RGB works. Check for pulses at pins 43 and 47 of IC U22. If pulses are missing, check IC U22. If pulses are present, check IC U57 and check voltages and components associated with Video Amp Transistor Q1.

VIDEO SYNC

No vertical or horizontal sync to a Monitor connected to the RF Modulator or to Video Connector CN8. Check VIC IC U21.

Vertical or horizontal sync missing on Connector CN2 connected to RGB Monitor. Check for pulses at pins 4 and 20 of Video Controller IC U22. If pulses missing, at either pin, check IC U22. If pulses are present, check Buffer IC U24.

Vertical or horizontal sync missing on Connector CN2 connected to Monochrome Monitor. Check for pulses at pin 19 of IC U22. If pulses are missing, check IC U22. If pulses are present, check IC U57 and check voltages and components associated with Video Amp Transistor Q1.

TIME OF DAY CLOCKS

CIA ICs U1 and U4 contain 24 hour time of day clocks that are used by some programs. If a program that displays or uses the time of day does not display or use time properly, use the following Basic program to check the clocks in ICs U1 and U4:

```
10 FOR X=56331 TO 56328 STEP -1
20 POKE X,5:POKE X+256,5:NEXT X
30 PRINT CHR$(147)
40 PRINT CHR$(19)
50 PRINT,"U1","U4"
60 PRINT "TENTHS ",HEX$(PEEK(56328)),HEX$
  (PEEK(56584))
70 PRINT "SECONDS ",HEX$(PEEK(56329)),HEX$
  (PEEK(56585))
80 PRINT "MINUTES ",HEX$(PEEK(56330)),HEX$
  (PEEK(56586))
90 PRINT "HOURS ",HEX$(PEEK(56331)),HEX$
  (PEEK(56587))
100 GOTO 40
```

The program puts the number 5 in the Tenths, Seconds, Minutes and Hours registers, then start displaying time from both IC U1 and continuously. If neither IC U1 or IC U4 is keeping proper time, check the waveforms at

pins 10 and 11 of IC U16. If the waveform is missing at pin 11, check Capacitors C79, C80 and C144, Resistor R7 and Zener Diode CR8. If the waveform is present at pin 11 and missing at pin 10, check IC U16. If only one of the ICs is not keeping the correct time, check the IC (U1 or U49) that is not keeping correct time.

COLOR

No color to a monitor connected to the RF Modulator or to Video Connector CN8. Check color clock waveform at pin 29 of VIC IC U21. If waveform is missing, check IC U28. If waveform is present, check waveform at pin 16 of VIC IC U21. If waveform is missing, check IC U21. If waveform is present, check voltages and components associated with Transistor Q1 and check Transistor Q1. Also see "Color RAM".

One or more colors missing on Connector CN2 connected to an RGB Monitor. Type in and run the following Basic program:

```
10 COLOR 5,3:PRINT "RED"
20 COLOR 5,6:PRINT "GREEN"
30 COLOR 5,7:PRINT "BLUE"
```

After running the program, check for pulses at pins 44, 45 and 46 of IC U22. If pulses are missing at any pin, check IC U22. If pulses are present, check Buffer IC U24.

SOUND

No sound. Type in and run the following Basic program to produce a continuous sound:

```
10 VOL 15
20 SOUND 1,10000,100
30 GOTO 10
```

While the program is running, check for pulses at pin 15 of Decoder IC U3. If pulses are missing, check IC U3. If pulses are present, check for 600Hz, .8V peak to peak at pin 27 of SID IC U5. If waveform is missing, check Capacitors C82 and C83 and IC U5. If waveform is present, check voltages and components associated with Audio Output Transistor Q2.

Computer generated sound works, external sound input (pin 5 of Video Connector CN8) does not work. Check Capacitor C93, Resistor R25 and IC U5.

COLOR RAM

RAM IC U19 is used to hold color information that goes to a composite monitor connected to the RF Modulator or to Video Connector CN8. If there is a problem with color on a composite monitor, the following Basic program can be used to check Color RAM IC U19:

```
10 DATA 1,2,4,8
20 FOR X= 55296 TO 56295
30 FOR Y= 1 TO 4
40 READ Z:POKE X,Z
50 IF PEEK(X) AND Z THEN 70
```

ALIGNMENT (Continued)

With head on Track 00, check for a gap of .01 inches between the Track 00 stop and the post on the Head Position Motor Pulley. If the Track 00 stop is out of adjustment, loosen the two screws holding the Track 00 stop bracket and adjust the bracket for a gap of .01 inches with the head on Track 00. Tighten the Track 00 stop bracket screws.

To check Track 00 Detector Adjustment, connect positive lead of voltmeter to pin 10 of Connector CN14. Check for 5.0V when head is on Track 1 and .2V when head is on Track 2. If Detector is out of adjustment, set head to Track 1 and loosen screws holding Track 00 Detector bracket. Adjust Track 00 Detector backward until voltmeter indicates .2V, then adjust it forward until voltmeter indicates 5.0V. Tighten Track 00 Detector bracket screw.

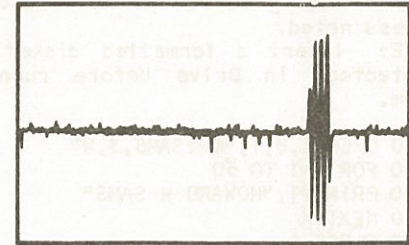
INDEX SENSOR ADJUSTMENT

Connect channel A input of a dual trace scope to TP1 (pin 3 of IC U108) and channel B input to TP2 (pin 4 of IC U108). Set scope for external trigger mode and connect external trigger input to pin 4 (Index pulse) of Connector CN14. Set scope to negative trigger slope, add mode with channel B inverted, sweep time to 50us, voltage range to .2V/cm and scope input to AC input. Set Drive Head to Track 34 (see "Alignment Test Setup"). Insert Alignment Diskette into drive and close door. Connect jumper from pin 3 of Connector CN17 to ground to keep drive running. Confirm timing between start of sweep (negative going edge of index pulse at pin 4 of Connector CN14 and first pulse of timing burst is 200us ±100us (see Figure 4). If timing is not within tolerance, loosen screw holding Index Sensor (M2). Adjust Index Sensor until timing is correct and tighten screw.

NOTE: The leading edge of the index pulse has

a very wide slope. This makes it difficult to do an accurate adjustment. View the index pulse with the scope and set the trigger point as close to the top of the leading edge of the pulse as possible and then do the above adjustment.

Figure 4



AZIMUTH CHECK

Connect channel A input of a dual trace scope to TP1 (pin 3 of IC U108) and channel B input to TP2 (pin 4 of IC U108). Set scope for external trigger mode and connect external trigger input to pin 4 of Connector CN14. Set scope to negative trigger slope, add mode, with channel B inverted, sweep time to .5ms, voltage range to .2V/cm and scope inputs to AC input. Set Drive head to Track 34 (see "Alignment Test Setup"). Insert an Alignment Diskette into drive and close drive door. Connect a jumper from pin 3 of Connector CN17 to ground to keep drive running. Pattern shown in Figure 5 should be displayed on scope.

Amplitude of bursts 1 and 4 must be equal to or less than amplitude of bursts 2 and 3.

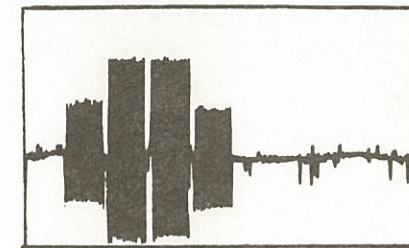


Figure 5

COMMODORE
MODEL C128D

DISK DRIVE NOTES

DISK DRIVE INTERFACE

Voltages, Waveforms and logic readings taken while running the following Basic program. Readings were taken when the disk drive head is not moving (drive is in read or write mode) unless noted.

NOTE: Insert a formatted diskette (not write protected) in Drive before running the program.

```
10 OPEN 1,8,1,"@0:SAMS,$,W"
20 FOR X=1 TO 50
30 PRINT#1,"HOWARD W SAMS"
40 NEXT X
50 CLOSE 1
60 GOTO 10
```

(1) Probe Indicates P when Head is moving.

- (2) Probe Indicates H when head is moving.
- (3) Probe Indicates L when head is moving.
- (6) Probe Indicates H if diskette is write protected.
- (7) Probe Indicates L if diskette is write protected.
- (8) Probe Indicates H when the head is on track 00 and L when off track 00.
- (9) Probe Indicates L when the head is on track 00 and H when off track 00.
- (10) Probe Indicates L when head 0 is selected, H when head 1 is selected.
- (12) Probe Indicates L when drive motor is off.
- (13) Probe Indicates H when drive motor is off.
- (18) Probe Indicates H when in write mode, L when in read mode.

POWER SUPPLY

Before servicing Power Supply, disconnect Connector CN7 from System Board to avoid possible System Board damage from high voltages that may occur while servicing Power Supply. Note: Do not operate Power Supply without a load. A #1129 lamp may be used as a load across the 5V Source (pins 3 and 4 of Connector CN7).

Power Supply dead. Check Fuse F1. If Fuse is open, check for possible shorts at Bridge Rectifier BR1 and Power Output Transistor Q1. If fuse is good, apply AC power and check for 120 VAC across Transformer T1 primary. If 120 VAC is missing, check Power Switch SW1 and Line Filter LF1. If 120 VAC is present, check for 156V at junction of Thermistor TH1 and pin 4 of Transformer T2. If 156V is missing, check Bridge Rectifier BR1, Thermistor TH1 and Capacitor C5. If 156V is present, check for waveform at base of Transistor Q1. If waveform is missing, check: voltages and components associated with Transistors Q1, Q3, Q4 and Q5; Optoisolator PC1; windings on Transformer T2.

No 12V Source. Check for 18V at pin 1 of 12V Regulator IC IC1. If 18V is missing, check Capacitors C11 and C51, Diode D9, and Transformer T2 winding continuity from pin 10 to 12. If 18V is present, check IC IC1 and Capacitors C19, C20, and C21.

No 5V Source. Check Coil L1, Diode D10 and Capacitors C12 and C14. Check continuity of Transformer T2 top winding.

No 9VAC Source. Check Fuse F2 and check continuity of windings on Transformer T1.

5V and 12V Sources are not correct. Check voltages and components associated with Error Amp IC IC2, Optoisolator PC1 and Regulator Transistor Q4.

MICROPROCESSOR (CPU) OPERATION

Computer does not boot up. Power supply checks good. Verify that oscillators and dividers are working properly (see "Oscillators and Dividers"). Check Reset circuit logic reading at pin 40 of IC U6. The reading should be logic low when Computer is turned On, then go high and stay high. The reading should go low when Reset Button (SW2) is pressed. If readings are not correct, check Reset Button (SW2), Capacitors C91 and C92, Diode CR16, Resistors R23 and R24, Timer IC U27 and IC U63.

OSCILLATORS AND DIVIDERS

Verify the 14.318MHz oscillator by checking for 14.318MHz at pin 14 of Clock IC U28. If signal is missing or frequency not correct, check Crystal Y2, Trimmer CT1 and IC U28. If signal is good, check for 8.1818MHz at pin 6 and 14.318MHz at pin 8 of IC U28. If either signal is missing, check IC U28. If signals are present, check for pulses at pin 10 of IC U37. If pulses are missing, check IC U37. If pulses are present, check for 1.0MHz at pins 18 and 23 of VIC IC U21. If either signal is missing, check IC U21. If signals are pre-

TROUBLESHOOTING

sent, check waveform at pin 6 of IC U10 and check for same waveform at pin 25 of IC U21. If waveform is missing at IC U10 and present at IC U21, check ICs U57 and U60. If waveform is missing at IC U21, check IC U21. Verify the 16.0MHz Oscillator by checking for 16.0MHz waveform at pin 29 of IC U107. If waveform is missing or frequency not correct, check Crystal Y1, Capacitors C116 and C117, Resistor R108 and IC U107. If waveform is good, check for 16MHz signal at pin 30 of IC U107. If signal is missing, check IC U107.

KEYBOARD

Keyboard does not work. Check Connector CN5 for good connections. If connections are good, check waveforms at pins 2 thru 8 of CIA IC U1. If any waveforms are missing, check IC U1. If waveforms are present, check operation of the keyboard by observing the logic readings on pins 9 thru 17 of IC U1 while pressing keys associated with the pin being monitored. If any logic readings are not correct, check key contacts on the keyboard. If readings are correct, check IC U1.

RESTORE key does not work. Check for logic low at pin 3 of Connector CN5 while pressing RESTORE key. If reading is not correct, check contacts on RESTORE key. If reading is correct, check for logic high at pin 4 of IC U16 while pressing RESTORE key. If reading is not correct, check IC U16. If reading is correct, check for logic low at pin 8 of IC U50 while pressing RESTORE key. If reading is not correct, check IC U50. If reading is correct, check for pulse at pin 6 of IC U27 when RESTORE key is pressed. If reading is not correct, check Capacitor C89 and Resistors R20 and R21. If reading is correct, check for pulse at pin 5 of IC U27 when RESTORE key is pressed. If reading is not correct, check Capacitors C20 and C90, Resistor R22 and IC U27. If reading is correct, check for pulse at pin 12 of IC U63 when RESTORE key is pressed. If reading is not correct, check IC U63.

C64-C128-CP/M MODES

Computer operates in C64 mode only (Commodore key held down while turning Computer On). CP/M and C128 modes do not work. Check ROM IC U34 and MMU IC U7.

C64 mode does not work. Check ROM IC U32 and IC U7.

CPM mode inoperative. If CP/M fails to boot with CP/M system disk in the Disk Drive when the Computer is turned On, check IC U7.

VIDEO

No video when using RF Modulator. Check waveform at pin 17 of VIC IC U21. If waveform is missing, check IC U21. If waveform is present, check for 5.0V at pin 1 of RF Modulator. If 5.0V is missing, check Coil L3. If 5.0V is present, check voltages and components associated with Transistors Q1, Q2 and Q3 on the RF Modulator board.

No video on a composite monitor connected to

MISCELLANEOUS ADJUSTMENTS

CHANGING DISK DRIVE DEVICE NUMBER

The Internal Disk Drive can be set to any device number from 8 to 11 by shorting or cutting two jumper pads located on the left side of IC U106 (as viewed from the front of Computer). Use the following chart to determine which pad to short or cut:
NOTE: Jumper 1 is the pad closest to the front of Computer.

Device Number	Jumper 1	Jumper 2
8	short	short
9	cut	short
10	short	cut
11	cut	cut

POWER SUPPLY VOLTAGE ADJUSTMENT

Connect the positive lead of a voltmeter to

pin 4 of Connector CN7 and negative lead to ground. Turn Computer On and adjust 5V Adjust Control (VR2) for a reading of 5.0 volts.

14MHZ OSCILLATOR

Connect input of a frequency counter to pin 8 of IC U28. Adjust Trimmer Capacitor CT1 for a frequency of 14.31818MHZ.

RF MODULATOR SOUND COIL

Connect Computer to a TV Monitor. Set TV and Computer Channel Select Switch to Channel 3. Type in and run the following Basic program:

10 VOL 5
20 SOUND 1,500,100
30 GOTO 10

Adjust the sound coil for best sound with Minimum noise.

TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

TEST EQUIPMENT

Equipment	B & K Precision Equipment No.	Sencore Equipment No.	Notes
OSCILLOSCOPE	1570A,1590A,1596	SC61	
LOGIC PROBE	DP51,DP21		
LOGIC PULSER	DP101,DP31		
DIGITAL VOM	2830,2806	DVM37,DVM56,SC61	
ANALOG VOM	277,111,116		
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	
COLOR BAR GENERATOR	1211A,1251,1260,1249	CG25,VA62	
RGB GENERATOR	1260,1249		
FUNCTION GENERATOR	3020,3011,3030		
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44 PR-28(HV)	HP200	
TEMPERATURE PROBE	TP-28,TP-30		
CRT ANALYZER	467,470	CR70	
DIGITAL IC TESTER	560,550,552		
CAPACITANCE ANALYZER		LC53,LC75,LC76 LC77	
INDUCTANCE ANALYZER		LC53,LC75,LC76 LC77	

LOGIC CHART

PIN NO	IC U101	PIN NO	IC U101	PIN NO	IC U102	PIN NO	IC U102	PIN NO	IC U103	PIN NO	IC U103
1	L	21	L	1	H	21	P	1	P	21	P
2	H	22	P	2	P	22	P	2	P	22	P
3	P	23	P	3	P	23	P	3	P	23	P
4	P	24	P	4	P	24	P	4	P	24	H
5	*	25	P	5	P	25	P	5	P		
6	H	26	P	6	P	26	P	6	P		
7	P	27	P	7	P	27	P	7	P		
8	H	28	P	8	P	28	H	8	P		
9	P	29	P	9	P			9	P		
10	P	30	P	10	P			10	P		
11	P	31	P	11	P			11	P		
12	P	32	P	12	P			12	L		
13	P	33	P	13	P			13	P		
14	P	34	P	14	L			14	P		
15	P	35	*	15	P			15	P		
16	P	36	*	16	P			16	P		
17	P	37	P	17	P			17	P		
18	P	38	P	18	P			18	P		
19	P	39	P	19	P			19	P		
20	P	40	H	20	L			20	P		

PIN NO	IC U104	PIN NO	IC U104	PIN NO	IC U105	PIN NO	IC U105	PIN NO	IC U106	PIN NO	IC U106
1	L	21	P	1	H	21	P	1	L	21	P
2	P	22	P	2	P	22	P	2	H(9)	22	P
3	P	23	P	3	P	23	P	3	P	23	P
4	P	24	P	4	P	24	P	4	L(10)	24	P
5	P	25	P	5	P	25	L	5	H	25	P
6	P	26	P	6	P	26	L	6	H	26	P
7	P	27	P	7	P	27	L	7	L	27	P
8	P	28	P	8	P	28	*	8	L	28	P
9	P	29	P	9	P	29	P	9	P	29	P
10	L(1)	30	P	10	L	30	H	10	P	30	P
11	L(1)	31	P	11	H	31	P	11	P	31	P
12	H(12)	32	P	12	H	32	L	12	P	32	P
13	H	33	P	13	H	33	L	13	L	33	P
14	H	34	H	14	H	34	P	14	P	34	H
15	H(1)	35	P	15	H(1)	35	P	15	L	35	P
16	H	36	P	16	H	36	P	16	L	36	P
17	P	37	P	17	P	37	P	17	P	37	P
18	P	38	P	18	P	38	P(18)	18	H	38	P
19	P	39	P	19	P	39	P	19	H	39	H(7)
20	H	40	P	20	L	40	P	20	H	40	P

COMMODORE
MODEL C128D

LOGIC CHART (Continued)

PIN NO	IC U107	PIN NO	IC U107	PIN NO	IC U107	PIN NO	IC U108	PIN NO	IC U109	IC U110
1	P	21	P	41	P	21		1	L	H(1)
2	P	22	P	42	*	22		2	H(1)	H
3	P	23	P	43	L	23		3	L(1)	H
4	P	24	P	44	H	24		4	H(1)	H(1)
5	H	25	P	45	P	25		5	L(1)	L(1)
6	H	26	P	46	P	26		6	L(2)	
7	P	27	P	47	P	27		7	H	
8	P	28	P	48	P	28	P	8	L	L
9	P	29	P			29	P(18)	9	H	L
10	P	30	P			30		10	L	H
11	P	31	P			31	L(10)	11	H(3)	L(1)
12	L	32	P			32		12	H(1)	H(1)
13	H	33	P			33	P	13	L(1)	L(2)
14	P	34	P			34		14	H(1)	
15	P	35	L			35		15	L(1)	
16	P	36	H			36		16	*	H
17	P	37	P			37		17		
18	P	38	P			38		18		
19	P	39	H			39		19		
20	P	40	H			40		20		

PIN NO	IC U111	IC U112	IC U113	IC U114
1	H(1)	H(12)	P	P
2	L(1)	H(13)	P	P
3	H(1)	P	L(1)	P
4	P	P	H(1)	P
5	P	P	P	P
6	P	P	P	P
7	L	L	L	L
8	L(1)	P	P	P
9	L(1)	L	P	P
10	L(1)	P	L(1)	H(7)
11	P(18)	P	H(1)	L(6)
12	P(18)	P	H(1)	H(9)
13	H	P	L(1)	L(8)
14	H	H	H	H
15				
16				

GENERAL OPERATING INSTRUCTIONS

POWER UP

When Computer is turned On, it will come up in C128 mode ready to program in Basic. To bring Computer up in C64 mode, hold Commodore key down while turning Computer On. If Computer is already On, it can be switched from C128 mode to C64 mode by typing GO 64 and pressing RETURN key. When Computer responds with "ARE YOU SURE?", type y and press RETURN key. Press RESET button to go from C64 mode to C128 mode. Note: Any program in the Computer will be lost when the Computer is switched between C128 mode and C64 mode. Save the program before switching modes. To run a Basic program after it is loaded, type RUN and press RETURN key. Press RUN/STOP key to stop program. Press RUN/STOP and RESTORE keys at the same time to return the Computer to its standard condition.

CP/M MODE

To bring Computer up in CP/M mode, insert CP/M disk in the drive, then press RESET button. If the 40/80 Display Key is in the up position, CP/M will come up in 40 column mode on RF Modulator for connection to a TV and video output for connection to a monitor. If the 40/80 key is down, CP/M will come up on the RGB output for connection to an RGB Monitor.

40/80 COLUMN MODES

The 80 column mode works in C128 and CP/M modes only and works only on an RGB Monitor. To get 80 column mode, put the 40/80 key in down position and press RESET key. To get 40 column mode, leave the 40/80 key up. The 40 and 80 column modes can also be switched by pressing and releasing ESC key, then pressing the X key.

RESET AND DRIVE RESET

The Computer can be reset by pressing RESET button (SW2) on the right side of Computer. Any programs in Computer will be lost when RESET button is pressed. To reset Disk Drive only, press DRIVE RESET button (SW3) on the right side of Computer. Pressing DRIVE RESET button will not erase any programs.

MACHINE LANGUAGE MONITOR

The C128 has a built-in machine language monitor program to enable the user to write, edit, save and load machine language programs. To enter the monitor from Basic, either press F8 Function key, then press RETURN key or type the word MONITOR and press RETURN key. To exit from monitor to Basic, type X and press RETURN key.

CASSETTE OPERATION

Plug a Datasette cassette recorder onto Cassette Connector (CN31) on right side of

Computer. Note: An ordinary cassette recorder will not work with the Commodore C128. To load a program, type LOAD, press RETURN key and follow instructions displayed on the Monitor screen. To save a program, type SAVE, press RETURN key and follow instructions displayed on the screen.

DISK OPERATION

IN C128 MODE: To get a directory of files on a diskette, type DIRECTORY (or press F3 Function key) and press RETURN key. To load a program from diskette, type DLOAD (or press F2 Function key), type the program name enclosed in quotes, then press RETURN key (DLOAD "name"). To save a program to diskette, type DSAVE (or press F5 Function key), type the program name enclosed in quotes, then press RETURN key.

A blank diskette must be formatted before it can be used. To format a diskette, use the following:

HEADER "diskette name",l1d,Ddrive#,Udevice#

The diskette name can be up to 16 characters. The l is followed by a two character identification. The D is followed by a drive number (0,1,2 or 3). The U is followed by a device number (8,9,10 or 11). If the green LED on the front panel starts blinking, it means an error in operation has occurred and an error message has been stored in Disk Drive memory. To read the error message, type DS\$ and press RETURN key.

IN 64 MODE. To get a directory of files on a diskette, type LOAD "\$",8 and press RETURN key. After the directory is loaded, type LIST and press RETURN key to view the directory on the Monitor screen. To load a program from diskette, type LOAD with the program name enclosed in quotes, followed by ,8 (for drive device number 8) and press RETURN key. Example: LOAD "SAMS",8. To save program to diskette, type SAVE with the program name enclosed in quotes, followed by ,8 and press RETURN key. Example: SAVE "SAMS",8. To format a blank diskette, type OPEN 1,8,15,"N0:name,l1d"CLOSE 1 and press RETURN key. Note: The N inside the quotes is followed by a zero.

To read the error message when the green LED on the front panel flashes, type in and run the following program:

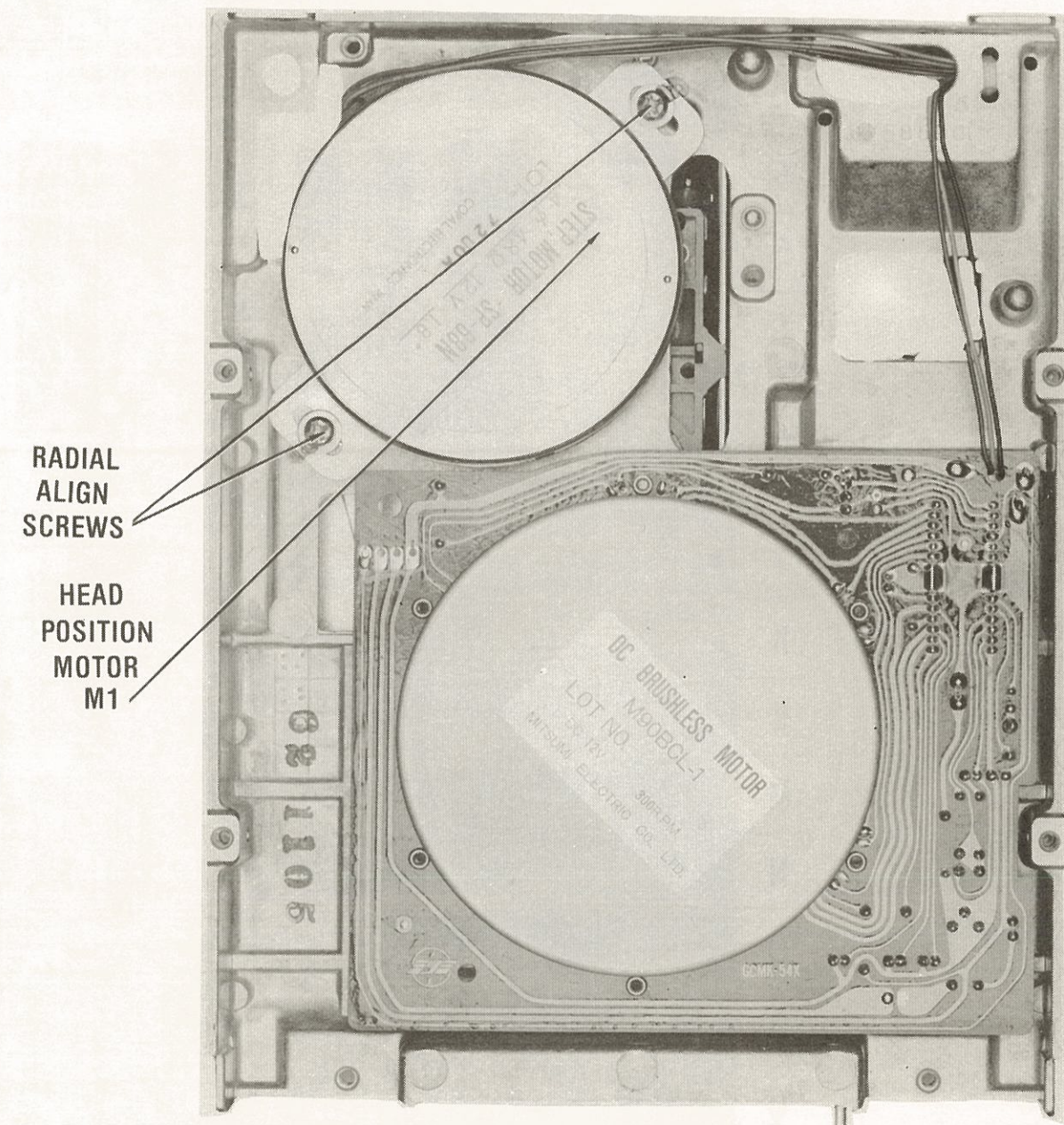
```
10 OPEN 15,8,15
20 INPUT #15,EN,E$,T,S
30 PRINT "ERROR # ";EN,E$
40 PRINT "TRACK # ";T,"SECTOR # ";S
50 CLOSE 15
```

The program displays the error number, message, track and sector where the error has occurred.

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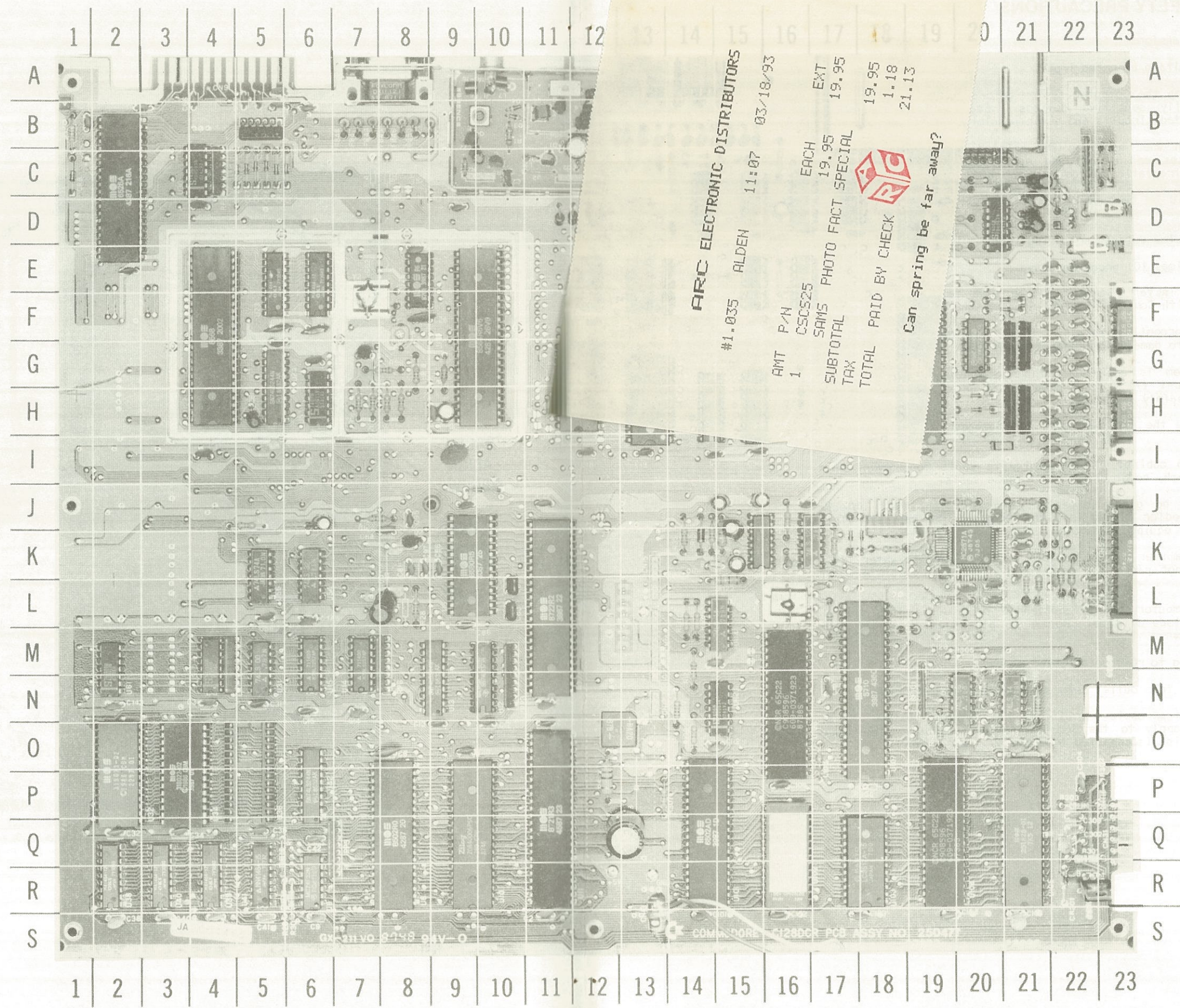
SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Computer system before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install Boards, Floppy Disk Drives, Printers or other peripherals with Computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This Computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the Computer system to water. If exposed to water, turn the unit Off. Do not place the Computer system near possible water sources.
14. Never leave the Computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning Computer system.
17. Never use liquids or aerosols directly on the Computer system. Spray on cloth and then apply to the Computer system cabinet. Make sure the Computer system is disconnected from the AC power line.



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DISK DRIVE - BOTTOM VIEW



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SYSTEM BOARD

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SYSTEM BOARD

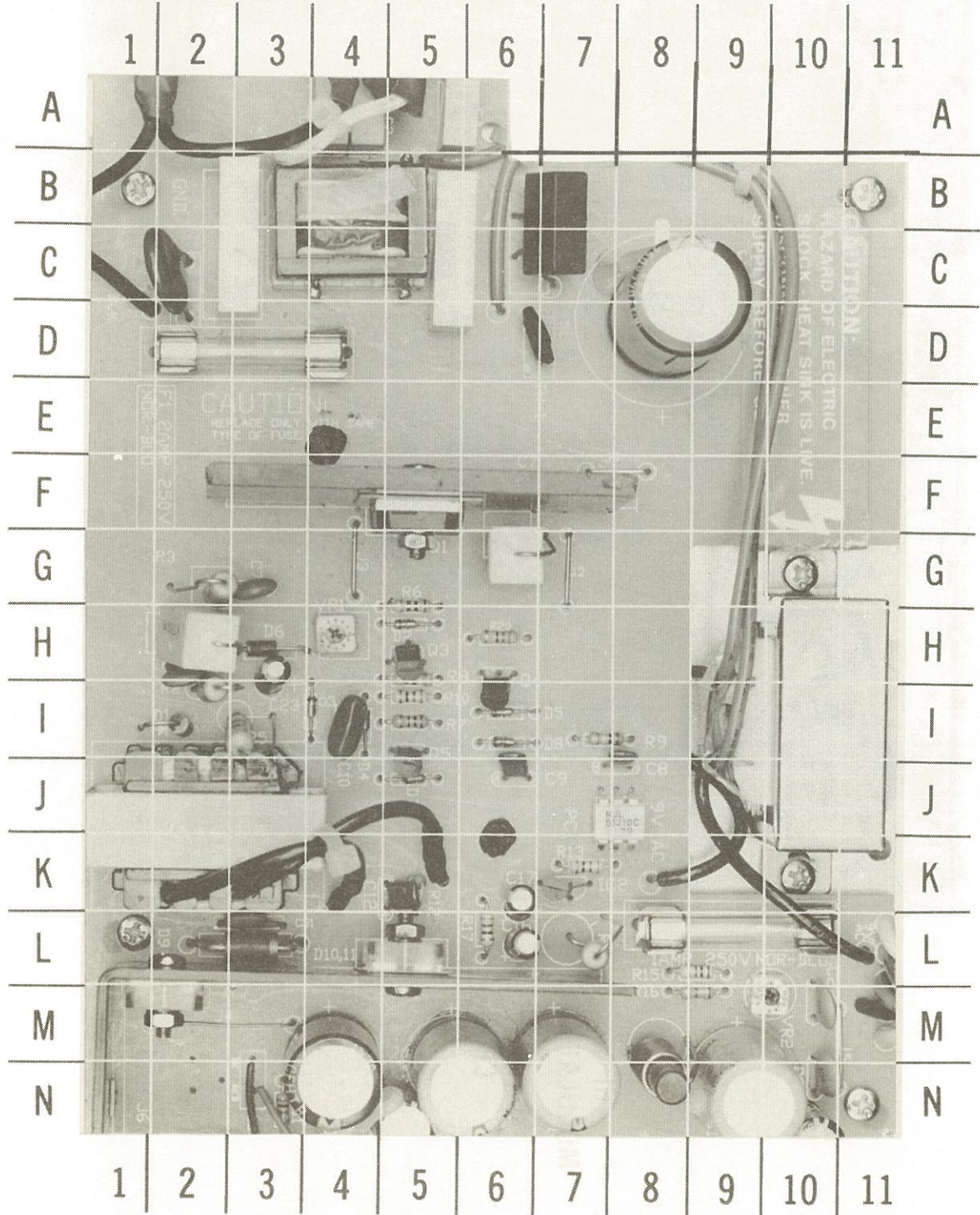
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COMMODORE
MODEL C128D

GridTrace LOCATION GUIDE

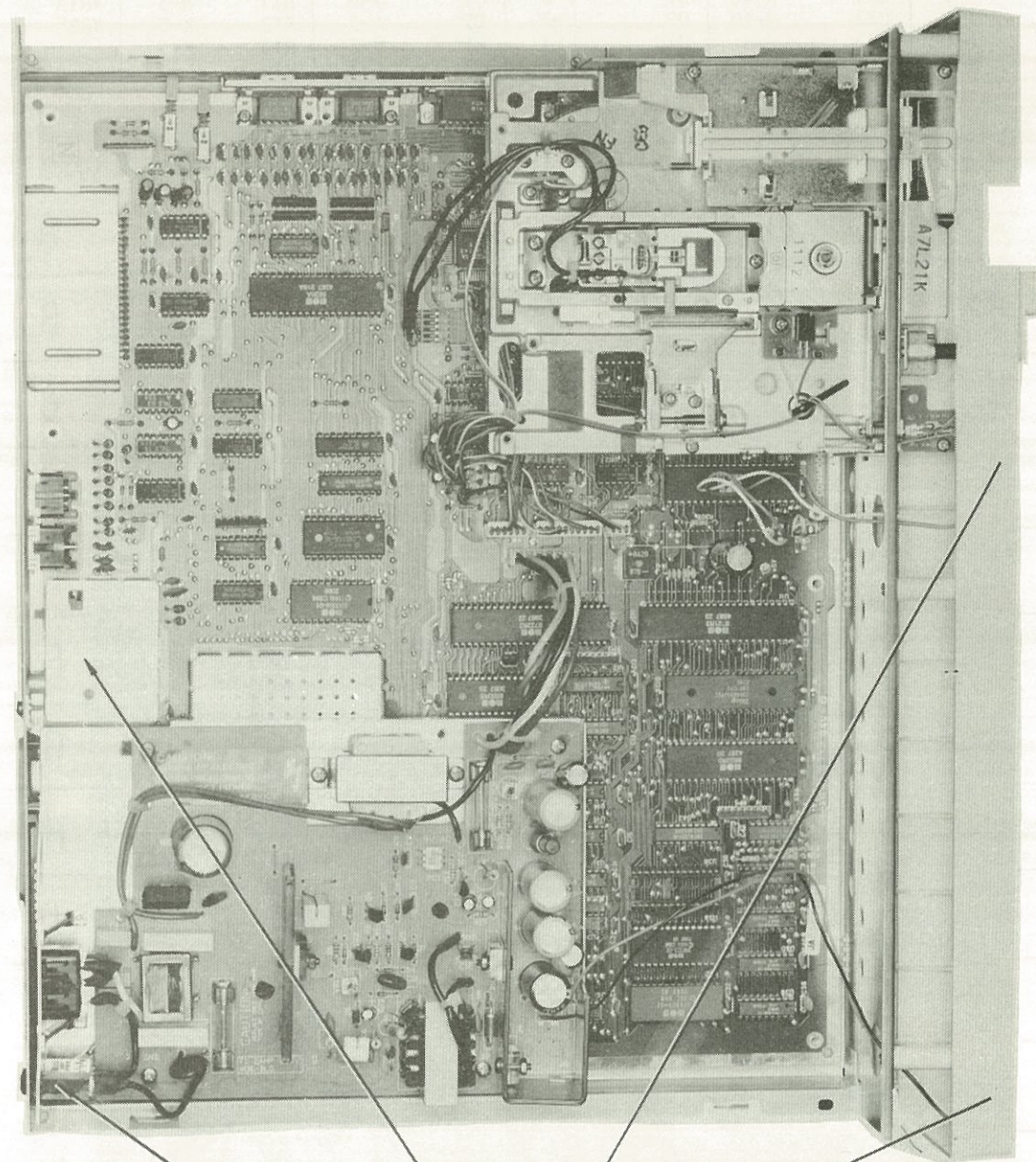
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C3	N-4	C81	K-8	C301	Q-22	J16	H-11	RP5	Q-6
C4	E-2	C82	L-10	C302	Q-22	J17	H-11	RP6	M-8
C5	J-9	C83	L-10	C303	Q-22	J18	H-11	RP7	E-14
C6	Q-8	C84	J-8	C304	P-22	L3	D-13	RP8	B-5
C7	N-11	C85	J-6	CN1	C-19	L4	G-9	RP101	N-19
C8	D-17	C86	L-9	CN2	A-8	L5	I-21	SW2	D-23
C9	S-6	C87	D-12	CN3	N-23	L101	L-22	SW3	E-22
C10	Q-9	C88	Q-13	CN4	F-23	L102	L-22	U1	H-19
C11	O-11	C89	D-19	CN5	K-23	L103	L-21	U2	G-20
C12	N-10	C90	E-19	CN6	A-14	L104	O-17	U3	M-4
C13	Q-9	C91	D-21	CN7	L-13	Q1	G-7	U4	C-2
C14	N-7	C92	D-21	CN8	A-13	Q2	K-8	U5	K-9
C15	N-6	C93	C-13	CN9	A-4	Q101	K-14	U6	R-8
C16	D-15	C94	D-12	CN12	J-18	Q301	R-22	U7	N-11
C17	I-14	C95	J-8	CN14	M-13	R1	Q-5	U8	D-17
C18	I-12	C96	K-9	CN15	L-13	R2	E-14	U9	R-6
C19	I-13	C97	K-8	CN17	N-13	R5	P-12	U10	R-9
C20	D-19	C99	F-22	CN31	Q-23	R6	J-5	U11	R-11
C21	I-9	C100	L-8	CR2	C-5	R7	B-1	U12	N-10
C22	I-4	C101	S-14	CR3	C-5	R9	C-16	U13	M-9
C23	F-5	C102	S-16	CR4	C-5	R12	J-7	U14	M-7
C24	G-5	C103	S-18	CR5	C-6	R15	C-20	U15	M-6
C25	F-6	C104	S-19	CR6	C-5	R16	H-7	U16	D-15
C26	F-13	C105	S-21	CR7	C-5	R17	H-8	U17	H-14
C27	C-19	C106	P-16	CR8	C-1	R18	G-8	U18	G-12
C28	F-8	C107	N-17	CR9	C-14	R19	H-8	U19	H-13
C29	D-9	C109	J-15	CR10	C-14	R20	C-20	U20	F-12
C30	D-4	C110	J-16	CR13	O-12	R21	D-20	U21	F-10
C31	N-5	C111	Q-20	CR14	C-23	R22	E-19	U22	F-4
C32	Q-2	C112	Q-14	CR16	D-21	R23	C-22	U23	E-5
C33	B-5	C113	O-21	CR17	J-10	R24	D-21	U24	G-5
C34	Q-3	C114	M-14	CR20	F-21	R25	C-14	U25	E-6
C35	D-16	C115	J-15	CR21	F-21	R26	H-7	U26	F-13
C36	Q-5	C116	L-17	CR22	H-20	R28	L-8	U27	D-19
C38	S-2	C117	L-16	CR23	H-20	R29	R-5	U28	E-8
C39	S-4	C118	L-22	CR101	K-14	R30	R-6	U30	C-4
C40	S-3	C119	O-20	CR102	K-17	R31	C-23	U31	M-5
C41	S-5	C120	O-21	CR103	K-18	R35	K-14	U32	O-2
C42	Q-6	C121	J-21	CR301	R-22	R39	G-8	U34	O-3
C43	F-22	C123	K-21	CT1	F-8	R51	E-16	U37	F-15
C44	F-22	C124	K-21	DP1	G-21	R54	H-16	U38	R-2
C45	G-22	C125	K-21	DP2	G-21	R107	K-17	U39	R-4
C46	G-22	C126	L-20	DP3	H-21	R108	L-17	U40	R-3
C47	F-22	C127	L-20	DP4	H-21	R110	J-21	U41	R-5
C48	G-22	C130	K-16	EMI40	B-13	R111	K-22	U42	P-6
C49	E-22	C133	K-19	EMI41	B-12	R112	K-21	U50	F-16
C50	E-22	C134	L-20	EMI42	B-13	R113	K-21	U54	K-6
C51	F-22	C140	K-15	FB7	B-14	R114	L-21	U55	H-15
C52	F-22	C141	J-15	FB8	B-15	R116	M-19	U56	K-5
C53	F-22	C142	F-12	FB9	B-15	R117	L-19	U57	H-6
C54	E-22	C143	N-2	FB10	B-15	R118	K-19	U58	D-16
C55	I-15	C144	D-14	FB11	B-15	R120	K-18	U60	D-14
C56	L-5	C145	L-6	FB13	B-14	R121	J-20	U61	M-2
C57	G-6	C200	L-22	FB14	B-14	R122	L-15	U63	D-20
C58	D-16	C201	I-22	FB15	B-13	R124	K-15	U101	R-14
C59	C-21	C202	I-22	FB18	C-15	R125	K-14	U102	R-16
C60	D-14	C203	I-22	FB19	B-12	R128	L-14	U103	R-18
C61	H-5	C204	L-22	FB20	B-11	R129	M-14	U104	R-19
C63	H-9	C205	H-22	FB44	B-7	R130	O-14	U105	R-21
C64	A-4	C206	H-22	FB45	B-8	R131	L-14	U106	O-16
C65	A-4	C207	H-22	FB46	B-8	R132	J-16	U107	O-18
C66	A-4	C208	G-22	FB47	B-7	R133	O-19	U108	K-20
C67	B-6	C209	G-22	FB48	B-7	R134	N-20	U109	K-16
C69	C-21	C210	G-22	FB49	B-9	R150	N-14	U110	K-17
C70	E-8	C211	I-22	FB50	B-8	R161	N-21	U111	N-20
C71	E-22	C212	L-22	FB106	M-18	R301	Q-22	U112	N-15
C72	H-9	C213	I-22	J1	F-9	R302	P-23	U113	N-21
C73	G-20	C214	I-22	J7	J-12	R303	P-22	U114	M-15
C75	D-18	C215	H-22	J7A	J-12	R307	P-13	Y1	L-16
C76	A-5	C216	H-22	J7B	J-12	RP1	C-4	Y2	F-7
C77	J-11	C217	H-22	J10	C-8	RP2	C-22		
C78	B-3	C218	I-22	J11	C-8	RP3	N-10		

GridTrace LOCATION GUIDE

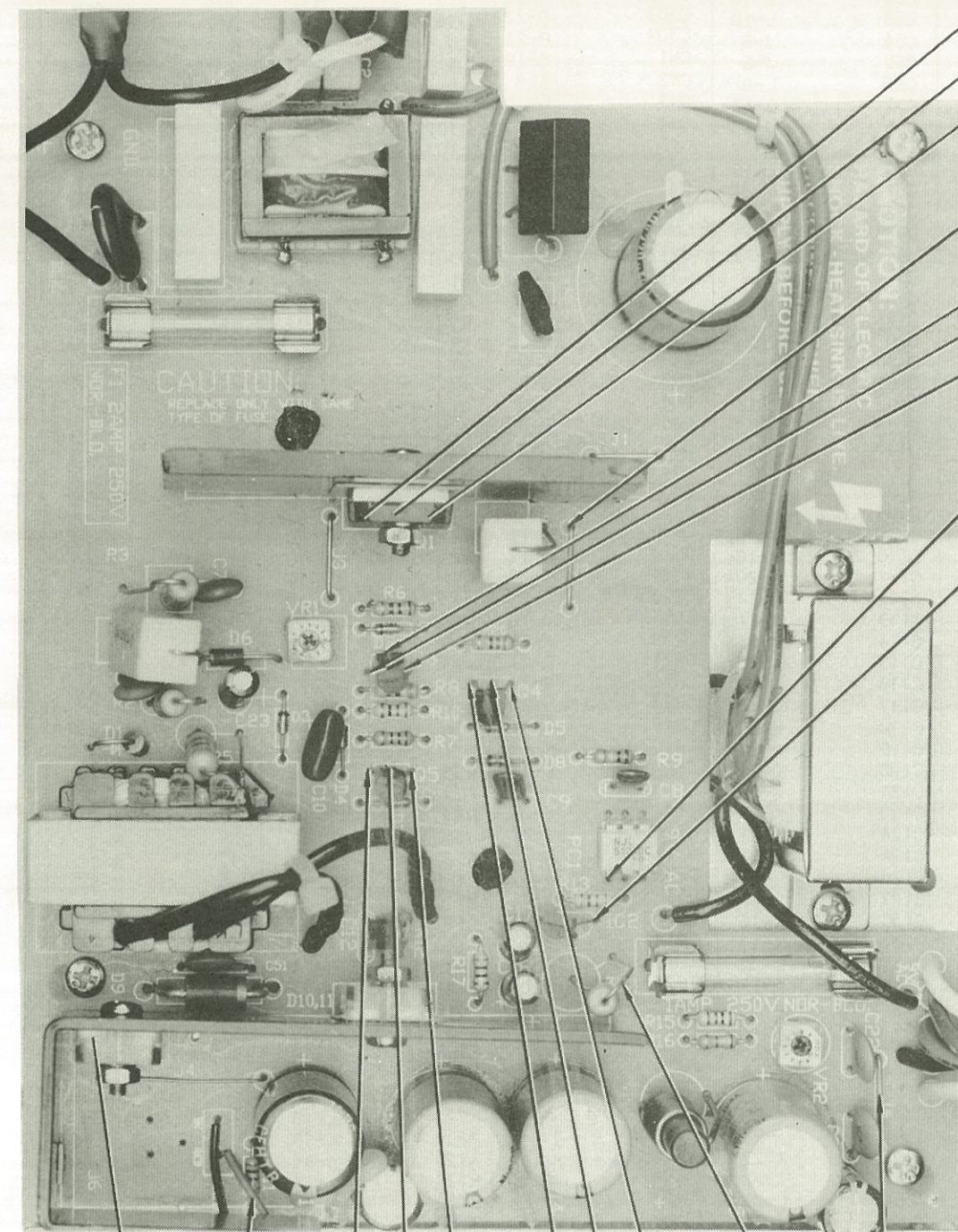
BR1	B-7	C12	K-5	C51	L-3	F2	L-9	R3	G-2	R15	L-9
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C2	A-4	C14	N-7	D2	H-5	IC2	K-7	R5	I-3	R17	L-6
C3	A-4	C15	N-9	D3	I-4	L1	N-8	R6	G-5	R20	H-6
C4	A-5	C16	L-6	D4	I-4	LF1	B-4	R7	I-5	T1	H-10
C5	C-8	C17	K-6	D5	I-6	PC1	J-8	R8	H-5	T2	J-1
C6	H-2	C19	N-5	D6	H-3	Q1	F-5	R9	I-7	TH1	D-6
C7	G-3	C20	N-10	D7	J-5	Q3	H-5	R10	I-5	VR1	H-4
C8	I-8	C21	N-10	D8	I-6	Q4	I-6	R11	N-3	VR1A	C-2
C9	J-6	C22	M-10	D9	L-3	Q5	I-5	R12	K-5	VR2	M-10
C10	I-4	C23	H-3	D10	L-5	R1	H-2	R13	K-7		
C11	N-4	C24	C-5	F1	D-3	R2	I-2	R14	L-7		



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CHASSIS - OVERALL VIEW



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IC1
2
11.9V

B
C
Q5

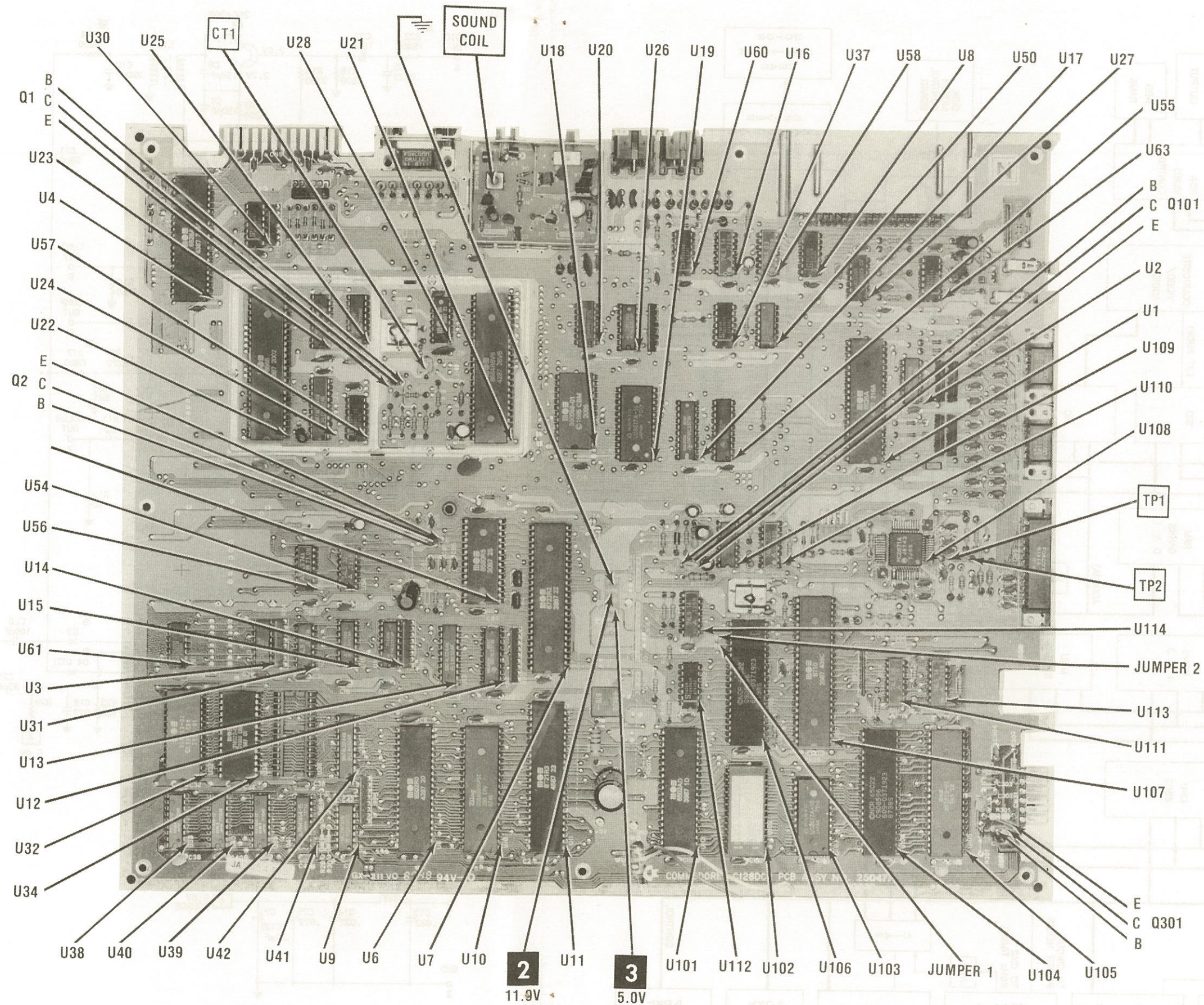
E
B
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3
5.0V

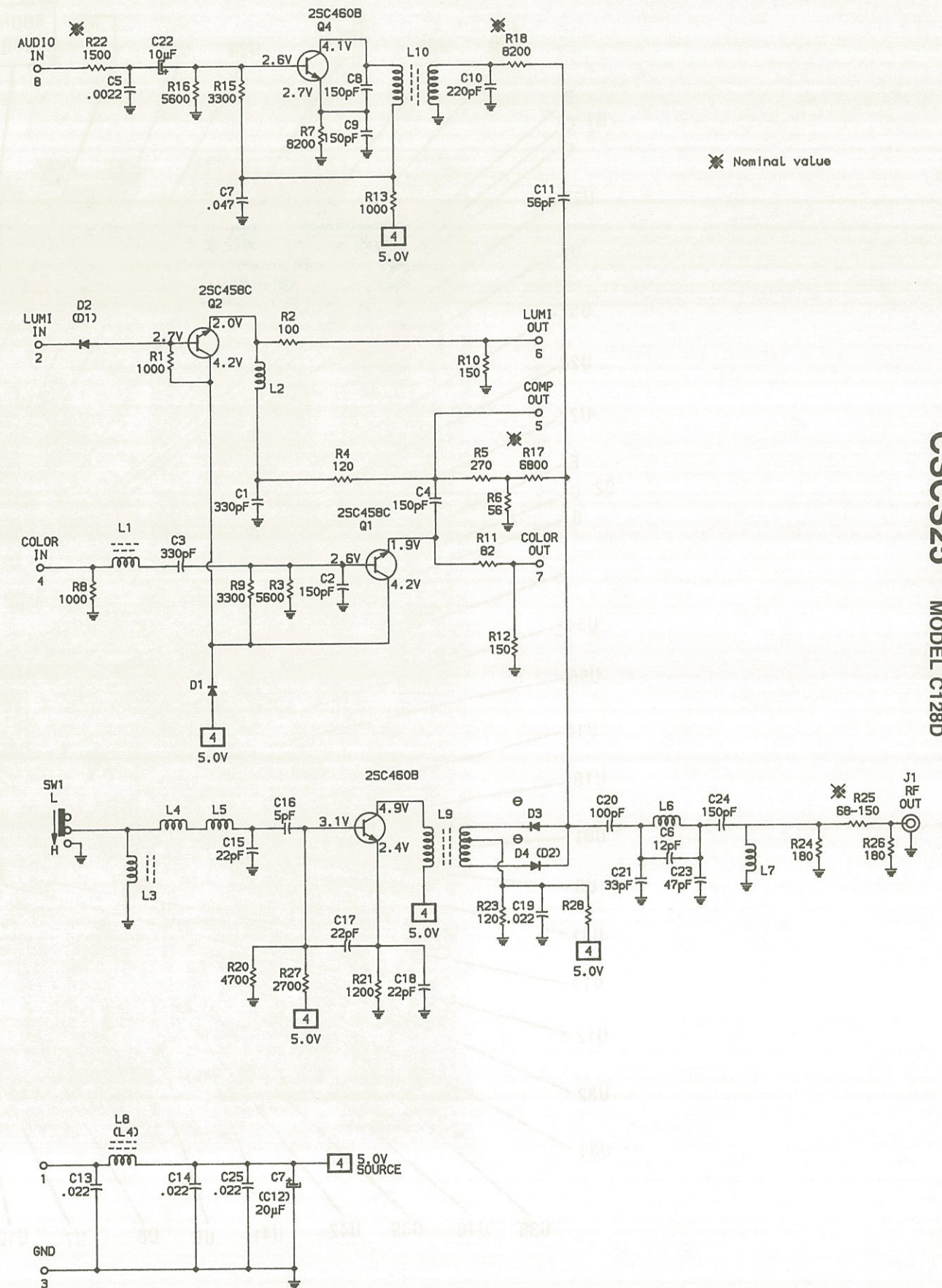
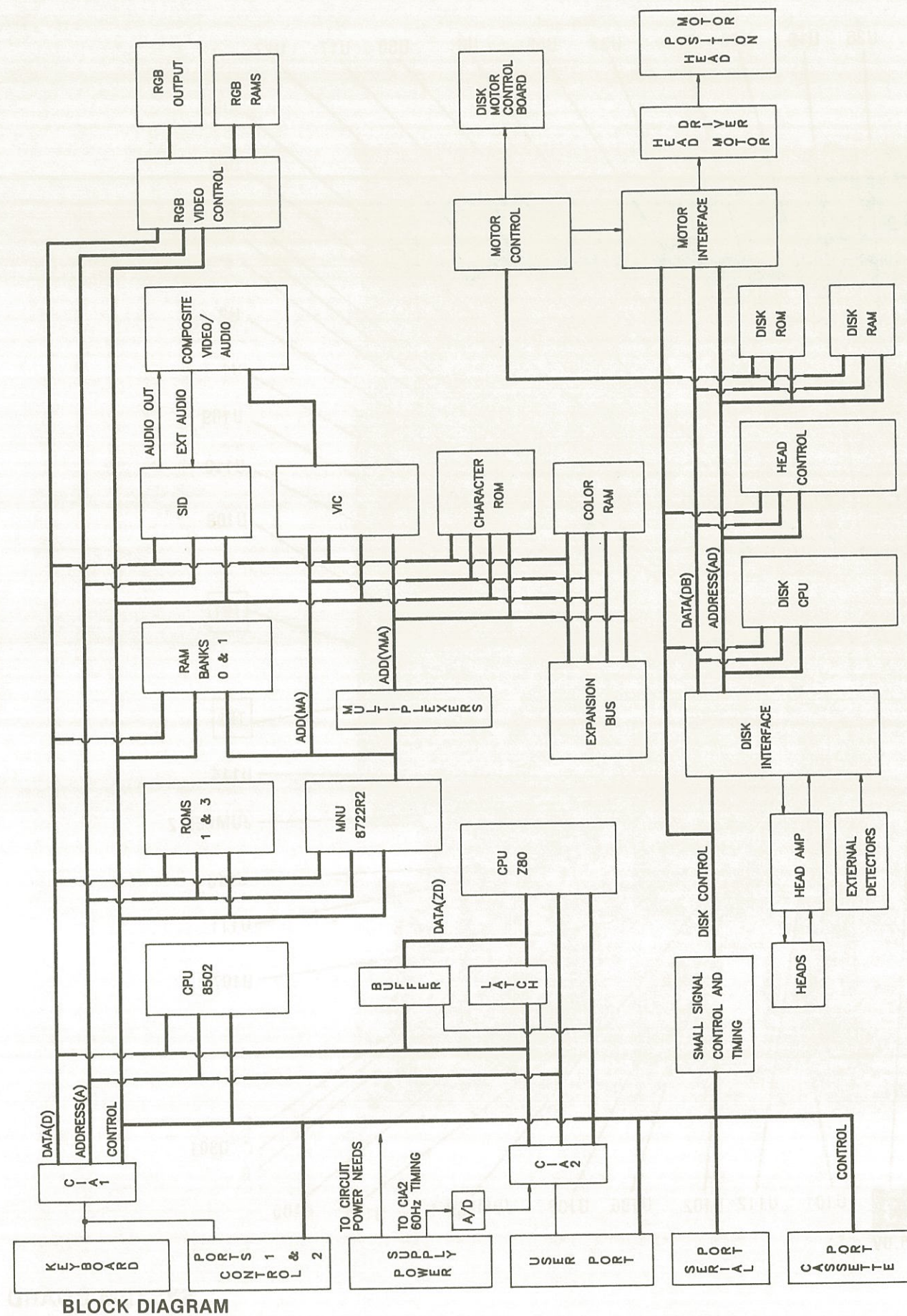
B
C
Q1
E

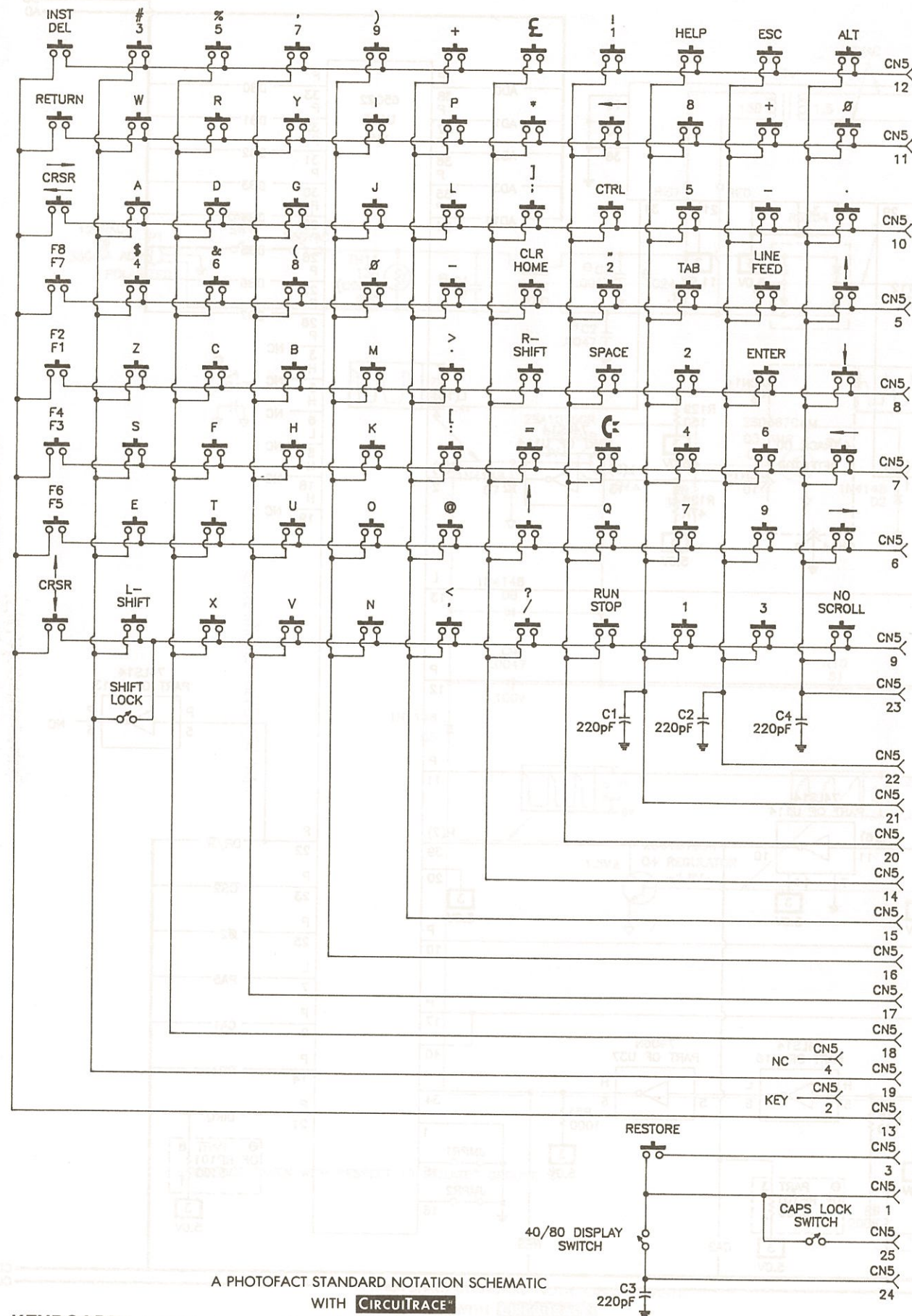
C
B
Q3
E

PC1
IC2



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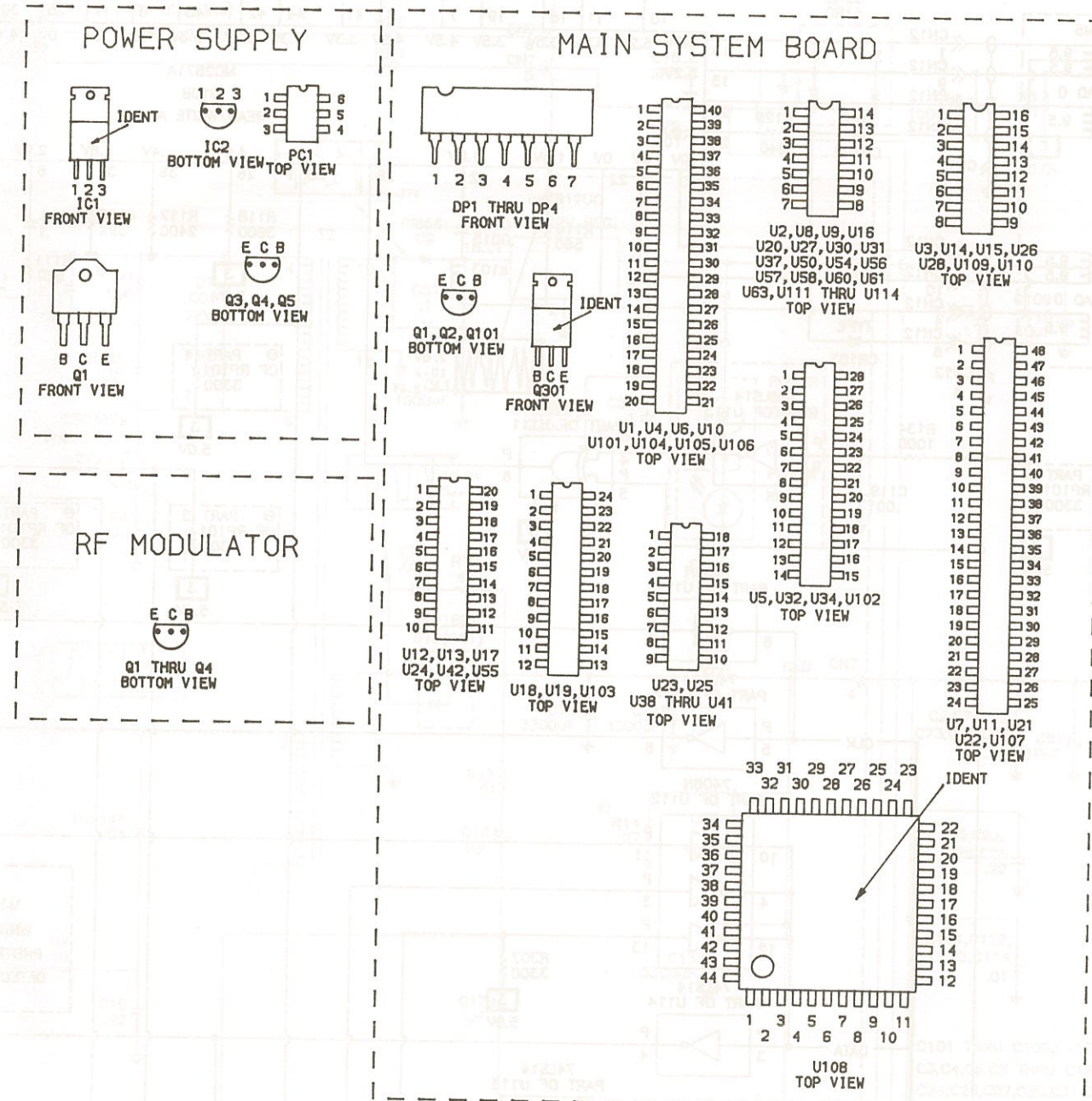




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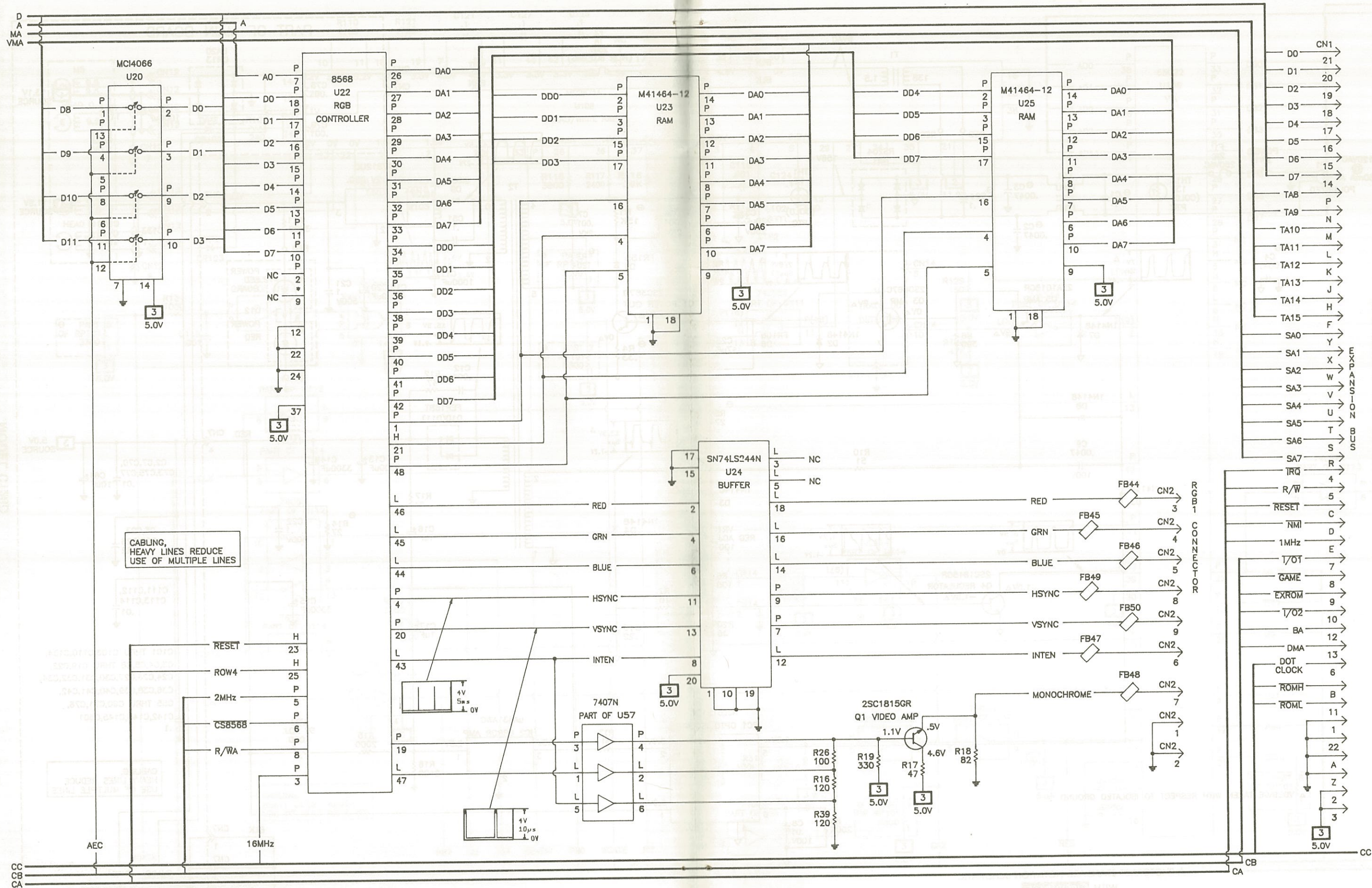
KEYBOARD

TERMINAL GUIDES



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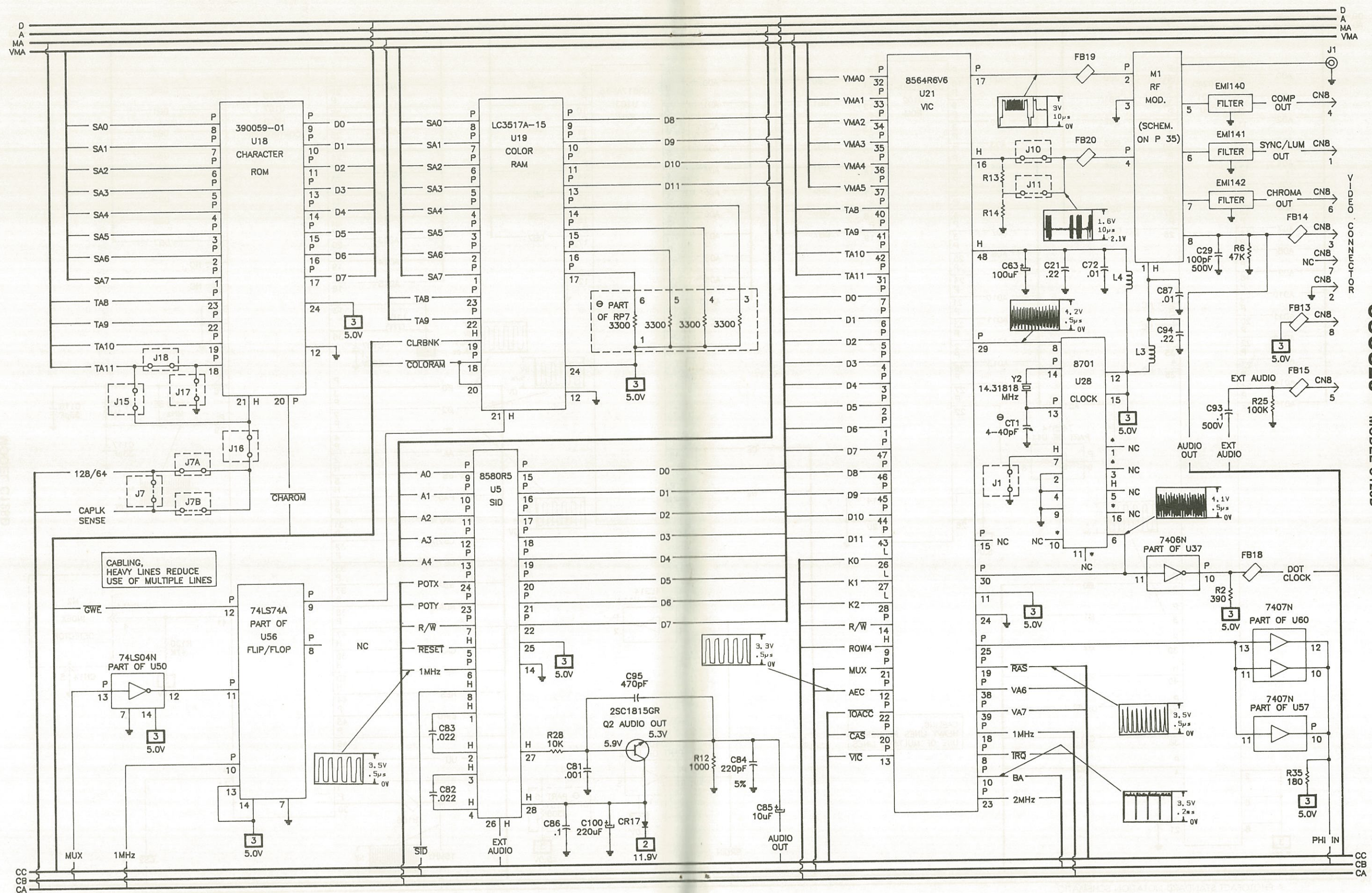


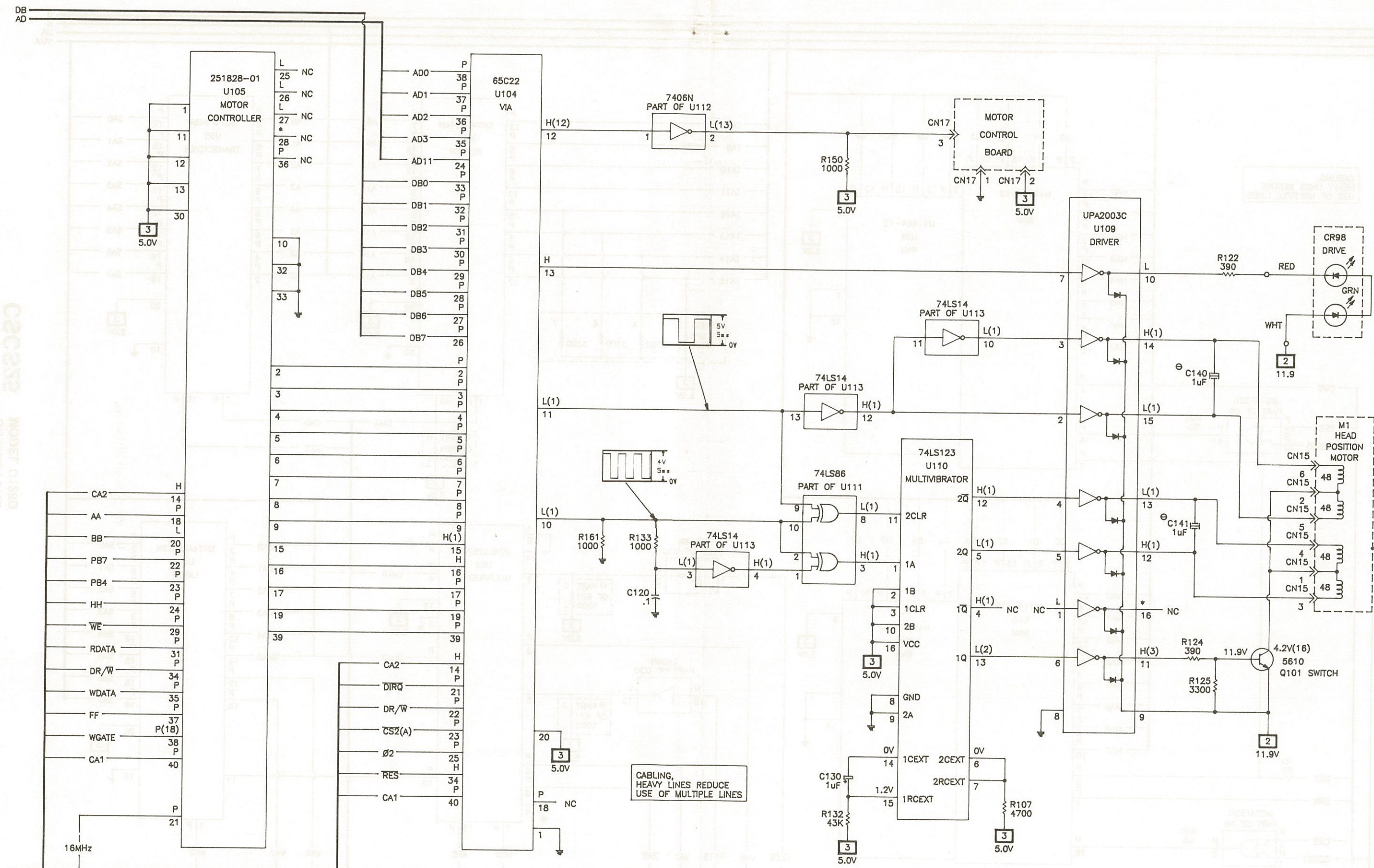
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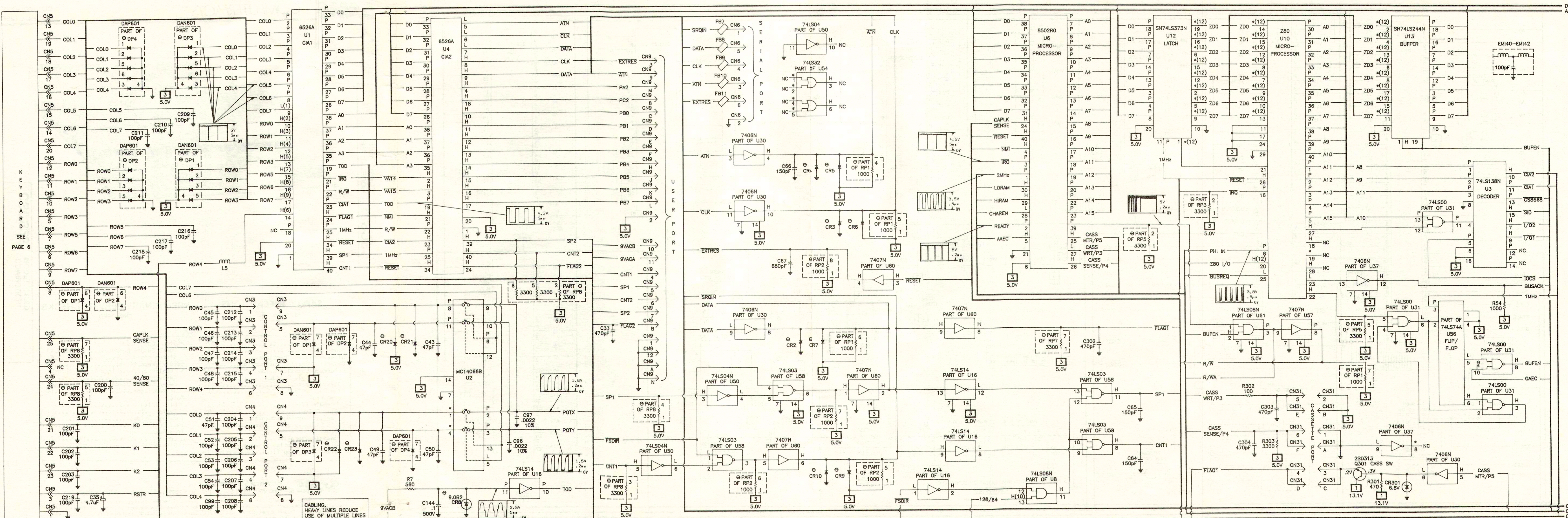
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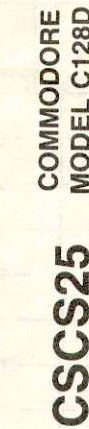
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PRELIMINARY SERVICE CHECKS

ENCLOSED

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